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The Allahabad Farmer

PUBLISHED QUARTERLY

Undenominational in Scope and Interests

Vol. VII JANUARY, 1933 No. 1

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THE
ALLAHABAD FARMER

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FROM THE EDITORIAL SANCTUM.

The Editorial Department of *The Allahabad Farmer*, the staff and students of the Agricultural Institute, Allahabad, wish our many and valued readers in all parts of India—

"A Very Happy and Prosperous New Year."

The year that has just closed has probably had no exact parallel in history. It has been a year of unsettled conditions in every realm of human endeavour. In many respects, however, there have been indications of definite advances made back to more prosperous times. The policy of Governments to balance budgets and carry on in a solvent fashion should also be our individual policy in the coming year. Standards of living must be brought within the compass of earning capacity. Earning capacity and income must be increased.

There is, however, no room for pessimism. Shrinking incomes, the high cost of living, and the depression generally should not be used as arguments for procrastination of the things we really ought to set out to accomplish this coming year. In fact, now is the time to get in on the ground floor and to stiffen the resistance against the inertia of idleness. This is the year to clean up your doorstep, to start that backyard poultry pen, to plant out a few fruit trees, to beautify your surroundings, to start growing your own vegetables. These things will add to your experience, enjoyment, and profit.

This is also the year in which to eliminate waste and carelessness from all your activities and operations. Your dividends will be manyfold the expenditure of time and labour.

Let this year be one of intensive application of brain and energy to every problem that confronts us !

* * * *

Napier Grass. We are still pleased to say that only one adverse report has been received from our readers with regard to experience in growing Napier Grass. If you have not heard of it, or tried it, let us send you full particulars. It is the

Use Cheddar Cheese once a Day.

most economical grass for fodder to grow that we have as yet had experience with on this farm.

* * * *

Door-fronts for Trap-nesting.

The winter season is the time to check up on your birds. The process is simple. Simply leg band your birds and keep a trap-nest for egg-laying. This is the only sure of way knowing which birds are boarding at your expense. Sample trap-nest door-fronts can be supplied at 12 annas each, postage extra. These can be fitted to any nest box.

* * * *

A New Commercial Dairy Product for India.

In this number our esteemed readers will find a note on the preparation of *Dahi* with a lactic acid-producing ferment. *Dahi* in this country needs no introduction. Its consumption is as old as the hills. However, the improvement of *Dahi* and its commercial manufacture by the use of pure cultures of Lactobacillus Bulgaricus is something new. The product is made from pure milk using the pure culture. We can now supply these cultures to any of our readers who may wish to propagate their own at the price stated in the article.

* * * *

Opportunities in Fruit-growing.

The attention of our readers is directed to the short introductory article by Mr. W. B. Hayes on "Opportunities in Fruit-growing." Mr. Hayes has succinctly analysed the situation. A new class of fruit-growers must be developed if fruit-growing is to develop and fruit products compete in the world market. Study your opportunity, and, if we can help you, do not hesitate to write to Mr. Hayes. We welcome every opportunity to be of service provided that an encyclopaedia of information is not requested on a reply-paid post card.

* * * *

Bertryl Seeds.

With this number we welcome the addition to our advertising pages of Bertryl Seeds, Mussoorie (late Penny Seed Store). In securing this advertisement we are again endeavouring to extend the acquaintance of our readers with reliable firms. Look over our advertisements carefully. Each firm is one of established repute. When you patronise our advertisers our reputation is at stake. We shall be glad to hear of any complaints and also good service in connection with our advertisements. Our readers receive the best of attention from our advertisers. Be sure you mention *The Allahabad Farmer* in writing.

THE MANAGING EDITOR,
"ALLAHABAD FARMER"
AGRICULTURAL INSTITUTE, ALLAHABAD.

DEAR SIR,—

Herewith the names and addresses of four friends whom I have approached with regard to subscribing to *The Allahabad Farmer*. Kindly send the next number to them by V.-P.P. for Rs. 2 (net), and extend my subscription period for one year from date of expiration of my present subscription (free.)

Yours truly,

(Name in block letters).............................

Full address...

Date.................

(NAMES AND ADDRESSES IN BLOCK LETTERS.)

1. ....

2. ....

3. ....

4. ....

Back Numbers of "The Allahabad Farmer."

What do you do with your copy when you have read it? Do you throw it into a corner and forget about it? Or do you do a little social service and pass it on to a friend? Or do you keep your numbers together and have the yearly numbers bound?

* * * *

Do You Want a Cheaper Magazine?

The subscription charge of Rs. 2 per annum just about covers the cost. It does not leave us any room for free copies; it does not allow us to publish very much illustrated matter, as blocks are expensive. You can decidedly help us to increase the scope of our magazine by becoming a living part of our organization, by sending us notes on your observations, experiences, helpful hints, etc. You can also help us in our endeavour to give you the best possible by helping us to increase our list of subscribers in every part of India. During this year we definitely hope that new subscribers will enrol to such an extent that we will be justified in placing the magazine on a bi-monthly instead of a quarterly basis. We look forward, finally, to a monthly journal. During this year we wish our subscription list to at least quadruple itself. If we secure the response you can depend upon us to do the rest. In this number we are enclosing a blank with four names on it. How many of you will respond by filling up the same and returning to us?

For each four new subscribers received through your efforts we will automatically extend your subscription period for one year.

Let us be mutually helpful. We will watch the mails for your response!

* * * *

Dairy Graduates.

A number of young men graduated from this institution in December last after completing the two-year course leading to the Indian Dairy Diploma given by the Imperial Department of Agriculture. Some of these men are looking for commercial openings in Dairying. If you know of anything or are in need of a good man for your dairy or farm just drop us a line.

* * * *

At the time of going to press we are pleased to say that there are no less than a dozen young Dairy graduates busily engaged in the commercial dairy field in India. Reports indicate that their employers are satisfied with them, and that progress is being made by those who are working on their own.

Good luck in the new year and more power to them! India needs men of this type who can tackle the practical problems of Agriculture and Dairying.

* * * *

Pure Improved Seed—A Myth.

The man behind the scenes in the daily struggle against Nature to improve existing varieties of agricultural seeds is the plant breeder. His constant work and results often go by unheralded and his praises unsung. His name is legion.

But what good is it for old varieties to be improved and new varieties created if when these varieties get into general use, their purity cannot be maintained because of lack of the necessary organization?

In Canada, in the great wheat belt, tests were made in 1931, at the Dominion Experimental Farm, at Locombe, Sask. Field crop investigations showed that out of 715 samples tested only 509 were found suitable for seed. One sample from Central Alberta named by the grower as Marquis, was found to be 50% other varieties, including Huron, Garnet, and Early Red Fife. Another sample from Northern Alberta, named by the grower as Garnet, was 40% Marquis, 30% Huron, 20% Stanley, and 10% other kinds. Two other samples, named Kitchener by the growers, were reported to be O.K. if called Reward and Garnett, respectively. That is to say, the two samples were not mixed but wrongly named.

Pure seed of a particular variety is difficult to recognize. Even highly-trained cerealists and grain experts find difficulty in recognizing varieties in the grain and in the standing crop.

It is not surprising that a good many farmers who have not made a special study of the fine points, such as the shape of kernel and the glumes or chaff, should find themselves growing a mixture of several varieties that have been produced so prolificly by plant breeders and would be plant-breeders.

It is highly desirable that at least in every province, if not in every district, that plots of pure-named varieties of the grains of the district be maintained from which the cultivator can secure his seed requirements.

The growing of pure seed and the establishment of pure seed farms is a definite opportunity for Agricultural College graduates. The Department of Agriculture co-operates with progressive individuals in this matter. We hope this good work will be continued and expanded.

The Ram Krishna Mission.

It is interesting to note that the Ram Krishna Mission, Belur Math, district Howrah, have recently, in addition to religious and social service, extended their activities to include the development of one of the indigenous breeds of cattle—the Harriana. Missions of this kind can contribute a great deal to the general problem of cattle improvement because of their wide contacts with the villager. It is hoped that their activities will receive the necessary support from their followers and the local government.

* * * *

A New Method of Ghee manufacture.

Dr. Brahamchari has pointed out that *pucca* or boiled *ghee* is poor in vitamin A, and that it is little better than mustard oil in this respect. Yet boiling *ghee* is a somewhat universal practice in India. It is boiled in order to evaporate the moisture present and to increase the keeping quality of the *ghee*. The villager, however, as a rule does not prolong the boiling process, because he finds it profitable to sell the moisture and casein concealed and contained in his *ghee* at *ghee* rates. It is desirable, however, that the ultimate consumer secure a good pure product of reasonable keeping quality and low moisture content.

We submit that the universal practice of boiling ghee should be discouraged, and that other methods than boiling should be used to reduce the moisture content of *kachcha ghee*.

The method that can be most easily applied is one using the principle of centrifugal force. In America a product called butter oil is widely manufactured. This butter oil product contains about 99·5 % pure fat, the remainder being casein and moisture. The butter oil is manufactured by rendering butter by heating it to a temperature of 160% F. and then running it through a Sharples Super-centrifuge. We have tried the ordinary hand cream separator for this purpose, but the separation secured does not eliminate the required amount of moisture.

It is not a practical suggestion to advocate that the villager install super-centrifugal machines to alter *kachcha ghee* to *pucca ghee*. It would, however, be practical and of commercial value to have centres in the larger towns and cities where *kachcha ghee* could be super-centrifuged instead of boiled in order to produce the *pucca ghee* desired by the ultimate consumer. There are certain established *ghee* exporting centres in India where it would also be practicable and advisable to establish the necessary plants for centrifuging.

Methods of *ghee* manufacture have undergone little change in India during the past centuries. Modern industrial methods

have not entered the field as yet. The above suggestion opens the way for this possibiity in the future.

* * * *

A Complete Reference on Vegetable Culture.

We are pleased to inform our readers that, commencing with the present number, we are running a series of articles on "Vegetable Culture." The final instalment will provide a complete reference on vegetable culture. At the outset we should like to advise our readers to carefully save all their copies and have them bound at a later date when the articles will be completed.

The articles are being written for us by Captain W. Sherrard-Smith and will be published under his *nom-de-plume* of "Sherrard." Captain Sherrard-Smith is well known as the Superintendent of the Government Gardens, Allahabad, and as the author of many practical books on Rose Culture, Chrysanthemums, the Making and Maintenance of Lawns, Flower and Vegetable Culture. Our readers will find a full-page advertisement in our advertising section, and, having read the books advertised, we can whole-heartedly recommend them to our readers.

PUNCTUATION

Punctuation is the art of making the divisions into sentences, clauses, or other divisions by points showing the relation and dependence of their several parts. This is a requirement essential to a correct and regular mode of expression. After learning the relative value of the points the best general rule is to place them where a pause would occur in speaking. The principal points, and rules for their use, are as follows:—

The comma (,) is used where you would make a trifling pause were you speaking. This sign makes the smallest division of a sentence.

The semicolon (;) makes a longer or more distinct pause than a comma, and is used to divide incomplete portions of a sentence.

The colon (:) marks a pause greater than a semicolon, and less than a period. It is used after a sentence complete in itself, but followed, without a conjunction, by some remark, inference, or explanation.

The period (.) is the point that marks the end of a complete sentence. It should also be used after every abbreviation.

The dash (—) is used to denote a sudden stop, an abrupt change of thought, a significant pause, or to add effect to other points.

The interrogation (?) must be placed after every question.

The exclamation (!) is used after every expression or sentence that denotes strong emotion.

The parenthesis ( ) is used to enclose a word or sentence, inserted by way of comment or explanation, and which is independent and not a necessary connection with the rest of the sentence.

The brackets [ ] are used to enclose a reference or to rectify a mistake.

The quotation marks (" ") are used to enclose borrowed or quoted expressions.

The apostrophe (') is used to denote that a word is contracted, or to indicate the possessive case of a noun.

By the careful observance and interpretation of these rules mistakes, or a misconstruction of the intended meaning, will be prevented, and attention will be enforced to certain words or passages which may require it.

The following effective illustration of an omission of the points of punctuation will be found highly amusing and instructive.

An inspector had been inspecting a school and had not been very well pleased with the work done by the teacher. Before leaving he went to the blackboard and wrote:

"The inspector says the teacher is an ass."

The teacher went to the board and added the following commas and pointed out the object lesson of punctuation to the class and also the Inspector :—

"The inspector, says the teacher, is an ass.

TO LET

A quiet Retreat or Missionary School.—To let at Sonada, nearDarjeeling a 7-roomed two-storey House (semi-detached), fully furnished ; with large Vegetable Garden and Playground. Ample supply of water ; situated near to Main Road and to Railway and Motors.

Rent Rs. 840, and no taxes to pay. For sale, at Rs. 6,750.—Apply to R. M. ROBERTSON, Architect, Darjeeling.

Without fail, read and study carefully Mrs. Vaugh's article appearing in this number on Landscaping our grounds in India." It will interest you, it will help you.

To be ignorant is no sin, but to remain so is!

Use Cheddar cheese Once A Day

LANDSCAPING OUR GROUNDS IN INDIA

MRS. C. P. VAUGH.

To most people the phrase landscape gardening has a rather formidable connotation. One generally expects it to be used in connection with a large area or formal park or something a bit more grandiose than a humble cottage in the hills or bungalow on the plains. But the dictionary defines the word landscape as "a portion of land or territory which the eye can comprehend in a single view, including all the objects it contains especially in its pictorial aspects." The purpose of landscape gardening is to arrange and modify the scenery so as to produce the best æsthetic effect by the arrangement of trees and shrubbery, opening or closing of vistas, the arrangement of roads and paths, etc.

We must all look somewhere in our daily approach to and egress from our own and others' homes and the more beautiful, restful and refreshing our immediate surroundings are the more spiritual benefit we get for our other work. We all, of course, appreciate our need for good food, books, etc. Most of us appreciate neatness in our work-rooms, school-rooms and homes. But somehow when it comes to the out-of-doors, our front yards, our gardens—well that just isn't (for most of us) a part of us. It does not generally express our personality but it should. It is in the *mali's* or the sweeper's or someone's else domain. We make some such flimsy excuse as, "Our *mali* simply doesn't know how" and put up with the hit and miss flower-beds, unsightly rat and mole hills, spoiling our smooth yards, unmowed dry grass, irregular irrigation ditches, even uncovered garbage or trash piles in our vegetable gardens, (an eyesore to our neighbors and the passersby if not ourselves), thorny or cactus hedges possessing no beauty of form or flower.

Who of us has not felt that if we had money or extra *malis* or an unlimited water-supply we, too, could have beautiful lawns or flowers! It is the aim of this paper, to help us to see that with limited resources of labour, money, water, and even ideas we can *all* modestly landscape our yards or compounds and express our personalities in our out-of-doors as well as in our drawing-rooms.

"Where there's a will there's a way" was never truer than in this matter of landscaping, especially in India. We're not handicapped with the rigors of a northern winter and our labour and most materials are cheap. Where, then, lies the difficulty? It is mostly with us. None of us can say we don't care. *We don't know how!* Therein lies the trouble. *To be ignorant is no sin, but to remain ignorant is.*

With the wealth of material in to-day's magazines there is little excuse for not knowing at least the rudiments of what goes to make pleasant surroundings. But where does one begin? We

must first ask ourselves a few questions. When we look from our windows what do we see? A smooth yard or a bumpy one?—weeds? Well-trimmed and well-placed shrubs? A hodge-podge of flowers? A tumble-down wall or line of servants' quarters? What do we see? Is it our neighbour's, or our own yard? What is the impression we get? One of space? One of messiness? A motley array of ill-chosen (*mali*-chosen, sometimes these terms are synonymous) flower colour combinations, unpruned shrubs, ragged thorny hedges, or a smooth vine covered fence, arbour or wall? What is the impression we want? Order, colour, space, greenness, restfulness.

We must have balance and a sense of harmony. The stiff florid cannas no longer take up the centre of attraction in the *centre* of the lawn. The laborious carpet bedding plants adjacent to the front door spelling a stiff lettered W-E-L-C-O-M-E is no longer in good taste. The welcome is there, manyfold, in the colour harmonies of shrub and flower that attract our discriminating eyes. If we are alone on a compound, landscaping it is one thing. If there are close neighbours it is another. If our compound or yard is new, it is easier if slower to landscape. We are fortunate if if there are trees and shrubs to begin with, and equally fortunate if there are none, for then we can choose our own plantings and placement. No hard-and-fast rules can be made to fit all conditions. Each compound, as each bungalow, has its own individual problem. There are three definite angles that must be respected in landscaping:—

1. The outside or approach to the house.
2. In the yard or garden itself.
3. Inside of the house looking out.

For instance, a tree well placed viewed from the inside of the house may spoil the whole landscape picture viewed from the outside and *vice versâ* a vista beautiful from the outside of the house may shut out the light from an important window.

When we decide upon the picture we wish to make, the next thing is to plan. We all know what kind of a room we would have if we got green curtains, blue pillows, and a red rug for our living room and yet many of us let our *malis* place flaming poinsettias and bright pink oleanders side by side—both beautiful in form and colour but glaringly atrocious if in too close proximity. Few of us could afford a landscape architect even if one were available. There are no nurserymen to whom we can appeal. So most of us have to do our own planning.

A Growing Love of Beauty

It should be kept in mind, however, that a growing love of natural beauty is more necessary than the knowledge of how to create it. Before knowledge must come interest in that knowledge.

You can tell the stage of development of the "garden mind" of each person by looking at his or her garden. No matter how completely the planting has been done it will need some additions every year. The true gardener changes "his picture."

Garden authorities agree it matters not so much what you plant, but it does matter a great deal how you plant, if your home grounds are to be attractive. The object of planting shrubs and flowers is to cause the house to "blend" into the lawn. Some horizontal-branched trees, shrubs, and perennials are needed to bring the house "down" and to soften the angles of the windows, doors, and corners and this is certainly true in India.

Children in the family will necessitate open spaces for play. They love the out-of-doors and should have facilities provided them for spending as much of their time as possible outdoors playing their games and enjoying the beauty and interest of the live and growing things that are an essential part of the garden. A *chabutra* or cement platform enjoyed in the hot evenings on the plains in the hot weather can be vine-covered (for shade) and in the cold season furnish an ideal place for play for our children when they are home from school for the winter. A wide-spreading, drooping-limbed tree makes an ideal place for children's play-houses, tea parties, or workers' meeting-place.

As one gives thought to the interests of the children the planning of the home grounds takes on a broader meaning. Shrubs and trees planted along the sides of one's yard, generally form the walls of an "outdoor room." Shade trees or vine-covered wire-fencing shields the grounds from the hot sun and gives privacy. Flower borders and lovely rose-beds provide fragrance and harmonious colours throughout most of the year.

The coal *godam* and other service delivery spaces should be kept hidden from view by an enclosure of shrubs. The garbage trenching must be in an out-of-the-way place, or at least screened from view not only of one's own front door, but also the next door neighbour's.

A Reason for Every Plant

Plantings should be confined to the boundaries of property and covers of foundations of a house. Plants must not be planted in a straight line nor dotted hit and miss over a lawn. There should be a reason for every plant, so that if asked why you have set this tree or that shrub you can answer, it sets off a doorway, brightens a dull spot, softens the lines of the house, or in some way detracts attention from the less desirable spot. A planting should never be made without knowing something about the ultimate height to which it will grow. Shrubs should be grouped in informal clumps so that as they grow they will merge together. "A

wreath of one kind of shrub around a house", someone has said, "makes the house appear as if thrown into a feather bed." It takes courage to remove trees or shrubs planted by a former owner or even by ourselves in past years, but sometimes the removal of an offending shrub or shrubs is the beginning of a new kind of beauty impossible before.

Too few, if any, of us are accorded the good fortune of having what is termed a good turf or a velvety lawn of fresh green. Our water-supply or perhaps more properly speaking—our salaries—prohibit that but most of us do not make use of the possibilities open to us. For the ordinary home yard (generally less than acre) without one extra man or one pice of outlay in seeds, water, or money we can see that our yards are level and attractive. An uprooted tree, a mole or rat hill—these things disturb the smoothness of our yards and yet in a few hours, sometimes minutes, all can be levelled smooth again. A blunt rake costs a rupee in the bazar. A good raking after a winter's rain, or an out of season shower will do much to give our yards a green appearance. A hand sickle is very cheap, costing annas 12 to Re. 1 and can be used quickly and effectively. The dry grass, after the rains, sends up uneven and aggravating shoots, seed heads, etc. If these are kept cut down to a smooth surface, the edges of the flower-beds clipped, seed pods removed, shrubs pruned, the yard or garden presents a well-cared-for, "groomed" appearance and one can more readily forgive it its brownish tinge. Of course, a well-groomed lawn cannot have odd bits of stone, a brick or so, broken twigs, yellow papaya branches and leaves lying about. It seems superfluous to mention these things, and yet——!

The principles of good composition demand that a picture shall have unity which means that the eye is carried around the various parts of it into a single composition. Trees help to do this. Large trees on a lawn cause the lawn to look smaller; often small trees or tree-like shrubs are more suitable.

A "point of interest" in the grounds is essential. In a room it may be a couch or the fireplace. In a garden it may be a bird bath, an arch, a rockery, a "blue and gold" spot, a rose garden, a stone seat, a gay parasol, a pool. One or two of these is sufficient. Accessories should be adjuncts of the garden and not disturbing elements. Arches are inviting to one's curiosity to see what lies beyond.

Variety is the spice of the garden. Most people chosing shrubs fear variety. Plantings of one variety have no abiding interest. The lay-out of the plants should be such that the individuality of each plant is not lost. A few shrubs should be given space enough so they may develop naturally and serve as points of interest.

Record Keeping

Don't try to fight Nature by growing those things not at home in your soil and climate. The wise gardener relegates novelties and untried plants to beds by themselves or tucks them in among the true and tried reliable plants. Forethought and careful selection will secure blossoms for every month and season from the rains through the hot days of the dry season. Inquire and *record the names of shrubs and perennials as they come into bloom so that you may know which you like and which would serve some definite purpose in your planting.*

Individuality, but not freakishness, is a desired quality of good planting. Copying the plantings of one's neighbours (no matter how beautiful) results in monotony. Gardens are significant of refinement and cannot be made by the gross.

Often it is necessary to use some fast-growing material for temporary effect while the permanent plantings are attaining sufficient size to fill the space allotted them. A row of servants' quarters or a village can be screened permanently by a tall hedge of *coronda*, but a quick-growing, yellow trumpet vine, railway creeper, or morning glory type of vine can be used for temporary covering ; a clump of feathery bamboos, poinsetlias, banana plants—all these are fairly quick in growth. Castor beans or the tall growing zinnias, hollyhocks and cosmos give height in a short time.

All this in general. These who are specially interested may get practical suggestions and helps from the following :—

1. Booklets on

   Practical Hints on Flower and Vegetable Culture in India; Making and Maintenance of Lawns in India ; Chrysanthemum Culture in India.

   All by Captain W. Sherrard-Smith, Alfred Park, Allahabad. Re. 1-0-0 per book.

2. Gardening in India, Percy Lancaster, Rs. 5.

   This a very worthwhile, comprehensive book.

3. The Amateurs' Vegetable and Flower Gardening :

   W. Wallace Johnstone, Rs. 4-8-0.

The research laboratories of the Dry Milk Company, Bainbridge, N. Y. report a practical method of irradiating milk to give it a high anti-ricket value. The method involves the use of high electrical frequencies for very short periods, allowing large quantites of milk to be treated economically and quickly.

OPPORTUNITIES IN FRUIT-GROWING*

W. B. Hayes, M. Sc., Horticulturist, Allahabad
Agricultural Institute.

There are many signs of increasing interest in fruit-growing in this country, and these are to be welcomed and encouraged. This agricultural industry has too long lain dormant, neglected alike by the public and the agricultural departments. The possibilities of improvement and expansion are almost unlimited, and, if taken advantage of, will result in great benefit both to the intelligent grower and to the consuming public.

One basic difficulty with Indian agriculture to-day is that while the average farmer has a very small acreage he grows crops suited to large-scale operations. The grains may give a comparatively high yield per man where land is plentiful, but they give a small yield per acre. More intensive crops are needed, especially in India where the population is so dense. Fruits and vegetables are such crops. Under the most favourable conditions in each case it is estimated that more food can be produced from one acre of bananas or plantains than from any other crop, sweet potatoes ranking second. If India would use fruits and vegetables more largely in place of wheat and rice the necessary food would be grown on less acreage, leaving more for such crops as cotton and for export crops, thus raising the level of prosperity. Similarly, the intelligent farmer with land suitable to fruits and vegetables can secure a larger income per acre in this way.

A Necessity.

It is also generally recognised that fruits and vegetables are a necessary part of a balanced diet. They furnish the necessary mineral salts and acids. Most fruits and some vegetables are valuable sources of the vitamines, citrus fruits, and tomatoes being especially rich. It is fortunate that such healthful foods are also attractive to the eye and to the palate. Nevertheless, the average citizen of an Indian city eats all too little of either fruit or vegetables, while these are practically unknown to most villagers for most of the year. One reason for this is the failure to understand their value ; another is the lack of a steady supply at low prices, due to inefficient production. Now that the public is beginning to appreciate the value of fruits, measures should be taken to improve production.

There is little hope of improvement as long as the fruit industry is left entirely in the hands of the castes whose hereditary occupation it is. These people are poor and uneducated and unwilling to change from ancestral practices. The author was once

* The *Pioneer*, Nov. 26*th*, 1932.

told by such a man that whatever he knew of horticulture he had learned in one life-time, whereas the caste man had the knowledge of many generations. In Western countries the fruit farmers are one of the most intelligent and progressive classes of farmers. A similar class must be developed in India if fruit-growing is to progress as it should.

Fruit-growing needs, and naturally attracts, men of unusual intelligence. As pointed out by Dr. J. M. Williams in his book, "The Expansion of Rural Life", " Successful fruit-growing requires unusual knowledge, skill, accuracy, and thoroughness . . . . in production and marketing. . . . . (The fruit-grower) must be a high type of business manager and must himself be skilled in every phase of the art of fruitgrowing." Such men are secured, not only because of the larger returns that are possible, compared with other types of farming; but, in the words of Dr. Williams, because, "In the first place, it is one of the most pleasant of agricultural industries."

Intelligent Practice.

The need for more intelligent practice in fruit-growing in India is apparent to one who makes a study of the question. Large numbers of varieties are grown of such fruits as the mango, many of them of very inferior quality. About 15,000 growers in California produce about 40,000,000 boxes of citrus fruits a year, but this is limited to two varieties of orange, two of lemon, and one of pomelo. Thus only the best varieties are grown, and the product is standard and dependable. Again, India grows many seedling trees, of no named variety, and of varying quality and production. A later article will go into more detail in some of the problems which are facing Indian fruit-growing, and which demand intelligent solutions.

The experience of other countries indicates that larger orchards are necessary to justify the expenditure for the needed tools and implements and the employment of specialists. Most Indian fruit gardens are entirely too small to be managed efficiently. Here is an opportunity for the investment of capital in such a way as will bring in a good income over a long period of years, and at the same time serve the country.

Equally obvious is the need for better marketing, and the opportunity to avoid waste. This will work to the advantage of both producer and consumer. The amount of fruit which is spoiled as a result of careless handling is appalling. Another large loss occurs due to glutted markets. The problems here are difficult, and demand a high type of intelligence.

An appeal was recently made by the Director of Agriculture, U. P., for the formation of a Fruit-growers' Association. It is to be hoped that those interested will respond.

HORTICULTURAL PRODUCTS

Preparation of Marmalade

A. D. Chand, F. Ag., J. A. V.

Marmalade is a clear jelly in which thin slices of fruit or peel are suspended.

Kind of Marmalades.—Sweet marmalade is usually made from the sweet varieties of oranges. It is very much relished by Americans.

English marmalade is rather bitter in taste and is made from a sour variety of orange. Similar marmalades may be made from sour lemon, sweet lemon, pomelo, grape fruit, *khatta* and *kumquat.*

Suitability of Fruits for Marmalade.—Marmalade, like jelly, is made from fruits containing desirable amounts of acid and pectin. The above mentioned fruits produce good marmalade separately, but the best results have been obtained by mixing three parts of orange and one part of *khatta* juices; equal weights of *kumquat* and orange juice produce a very pleasing marmalade.

Preparation of Slices.—A band of rind two-inches or so wide may be cut from some of the fruits, according to requirement, around their greatest circumference, and cut into $\frac{1}{32}$ of-an-inch thick and one or two-inch long shreds. These slices are boiled until soft and drained.

Preparation of Juice.—The fruits are cut into pieces, boiled until soft, and the juice is drained through a cloth bag, as in jelly-making.

Process of Preparing Marmalade.—An equal amount of sugar is added to the juice when it starts boiling, in order to get it readily dissolved. The cooking is continued, and near the end point $\frac{1}{4}$lb. of prepared slices of rind are added to every 3lbs. of juice taken. The end point is determined as in jelly-making, which is 218 to 220° F.

Before pouring the marmalade into the containers it should be partially cooled to avoid the slices of peels from floating on the surface.

Preparation of Tomato Sauce.

Preparation of Tomato Pulp.—The fully ripe red tomatoes are sorted, washed, cored, and placed in boiling water for five minutes, and then peeled off and smashed.

Recipe—

Whole peeled tomatoes	...	24lbs.
Chopped onions	...	1¼lbs.
Chopped garlic	...	2 cloves.
Salt	...	7 ounces.
Sugar (brown)	...	1½lbs.
Vinegar	...	1½lbs.
Red pepper	...	1 tablespoonful.
Whole all-spice	...	1 tablespoonful.
Cinnamon (ground)	...	2 tablespoonsful.
Whole cloves	...	1 tablespoonful.
Ginger (ground)	...	1 teaspoonful.
Mustard (ground)	...	1 teaspoonful.

Process of Preparing Tomato Sauce.—The chopped onions, garlic, chillies, mustard, and brown sugar are added to the pulp directly, and the spices are tied in a cheese cloth bag and placed in the boiling pulp. The cooking is continued until the desirable consistency is acquired. The vinegar is then added, and the product is brought to the boiling point, removed from the fire and poured into the wide mouth containers, because of the large pieces present in the sauce. Then seal it if required to be kept long.

Preparation of Ketchup or Catsup.

The tomatoes should be of intense red colour, meaty, and not watery in texture. They should have enough acidity and rich tomato flavour. The green tomatoes should not be used, because the green pigment of tomatoes turns brownish-red during cooking and greatly reduces the intensity of the natural colour and the quality.

Preparation of Pulp.—The tomatoes are sorted, cored, washed, crushed, and then boiled until they become quite soft. The pulp is rubbed through a copper wire seive to remove the seeds and skin.

Recipe—

Tomato pulp	...	24lbs.
Chopped onions	...	½lb.
Chopped garlic	...	1 clove.
Sugar	...	1½lb.
Salt	...	5 ounces.
Vinegar	...	1¼lbs.
Allspice	...	1 tablespoonful.
Cinnamon (ground)	...	3 tablespoonsful.
Whole clove	...	1 tablespoonful.
Nutmeg (ground)	...	1 tablespoonful.
Red pepper	...	1 tablespoonful.
Ginger	...	1 teaspoonful.
Whole mace	...	1 teaspoonful.

Process of Preparing Ketchup.—Put all the spices, chopped onion, garlic, and pepper in a small cheese-cloth bag ; tie it and place it in the boiling tomato pulp. Concentrate the pulp by boiling rapidly, and stirring occasionally to blend the ingredients and to avoid burning. The cooking is continued until about 8lbs. product is left.

The sugar and salt are dissolved in the vinegar, and, after removing the bag of spices, it is added to the finished product. The ketchup is then boiled for about five minutes and stirred thoroughly to blend the ingredients. After cooling to a certain extent it is poured into the small mouth bottles and corked. If it is to be kept for a long time the bottles should be sealed.

(To be continued.)

The common owl is one of nature's most effective controls for mice. Owls render the farmer a great service in helping him keep these pests under control, a fact which he all too seldom recognizes.

The Iowa Engineering Experiment Station is working out mathematical laws which will enable the calculation of the "life expectancy" of various kinds of machinery. The equations are based on a vast amount of data, somewhat similar to methods used by life insurance companies to predict the life expectancy of different groups of human beings. These new formulae will enable cost accountants to make more accurate estimates of the probable useful life of various machines than have hitherto been possible.

The most recent report of the Director of the Bureau of Animal Industry of the Philippine Islands gives the total livestock population of the Islands for the year ending December 31, 1930 as 6,952,155 distributed as follows:—

Carabaos (water buffaloes) ...	2,031,301
Cattle	1,217,928
Horses	344,448
Hogs	2,774,758
Goats	455,700
Sheep	128,020

VITAMIN VALUE OF KACHCHA GHEE.

B. B. Brahmachari, D. P. H.,

Director, Bengal Public Health Laboratory.

From my study on rats I have shown in the paper on The Vitamin Value of the Food Fats of Bengal, published in the *Indian Medical Gazette*, vol. 4XVII, No. 7 July, 1932, pp 309—318, that the *pucca* or boiled *ghee* is poor in vitamin A, being little better in this respect than the mustard oil, *i.e.*, the expressed oil of mustard. I have also stated in the same article that the *kachcha ghee*, being practically rancid butter, may be equivalent to butter in the vitamin value. After this I owed it to the public to put to test the latter problem, and in this article I submit the results of my investigation on it.

2. *Basal Diet.*—In this experiment, as in the preceding one, the basal diet was the same as that of Drummond and Coward (1920), only omitting orange juice and using Merck's soluble starch in place of *rice*; the salt mixture was also as before that of Mc-Collem and Simmonds (1918. The casein was thoroughly soxletted with petroleum ether and dried at 120°C to eliminate the little milk fat and to destroy completely any trace of vitamin A that might have been left in it. The diet thus consisted of—

Casein	...	...	19
Starch	...	...	55
Fat	...	...	16
Yeast	...	...	5
Salt mixture	...	...	5

3. *Fats.*—The fat for the test animals was, of course, the *kachcha ghee*. For control two rats had butter fat, *i.e.*, milk fat melted out of butter on the water bath, and three other rats had mustard oil instead of the *ghee*.

4. Rats experimented upon were nine in number, seven of one litter born on the 23rd May last, and two of another litter born on the 15th of the same month. All the five control animals were of first litter; two of them were placed on butter fat diet on the 23rd June, *i.e.*, when they were just one month old, the other three on the mustard oil diet on the 7th July, *i.e.*, three weeks later. Of the four test animals, *i.e.*, those kept on the *ghee* diet, two of the second litter were taken up on the 23rd June and the two of the first litter on 30th June; they were all about five weeks old. The starting weights of the two rats on butter fat were 40 grammes each, of those on *ghee* 50 grammes each, and of those on mustard oil 70 grammes.

5. *Procedure.*—Our object was not quantitative, *i.e.*, assaying of the actual amount of the vitamin in the test fat. All that we wanted to see was the gross effect of its concentration in the fat on the growth of the animals. So I did not devitamise the animals, this time, by putting them on lard for the fat as preparatory to the experiment. Instead I proceeded straight by placing the animals from the very beginning on the different fats, *viz.*, the *kachcha ghee*, the butter fat and the mustard oil. The departure, though taking away from the quantitative value which was not aimed at, made the condition more natural, *i.e.*, as might actually obtain with the dietary of the people. The effect on growth observed under this condition is what might be more reasonably extended to that on the human subjects than what could be got on animals prepared by artificial avitamosis. The rats on the butter fat as well as those on the *ghee* were kept in pairs; those on mustard oil were all female.

6. Result will be evident from a glance at the following table :—

Fat given.	Rat.	Date of Birth.	Date of Starting the Experiment.	Weight in grammes at the end of each week.												
				4	5	6	7	8	9	10	11	12	13	14	15	17
Butter	Male	23-5	23-6	40	60	90	100	110	120	140	160	160	150	150	150	150
Ghee	,,	15-5	23-6	..	50	60	80	90	80	100	110	120	130	140	150	150
Ghee	,,	23-5	30-6	..	50	80	90	80	110	120	120	140	145	150	150	150
Butter	Female	23-5	23-6	40	50	80	90	90	100	120	140	170*	..	..	..	..
Ghee	,,	15-5	23-6	..	50	60	90	100	90	110	120	130*	..	died	..	..
Ghee	,,	23-5	30-6	..	50	80	90	80	100	110	120	140	130	140	150	150
Mustard	Female	23-5	14-7	..	..	..	70	40	60	50	50	60	50	50	50	50
Oil	,,	,,	,,	..	..	..	70	50	60	50	50	60	60	70	60	60
Oil	,,	,,	,,	..	..	..	70	50	60	50	60	60	70	70	60	60

* brought forth litters.

(1) The three rats on mustard oil ceased to grow, and, after being on it for ten weeks, began to show sign of xerophthalmia. So the mustard oil, as well as the basal diet containing it, had little vitamin in it.

(2) The growth on the butter fat was the same as in the previous experiment referred to in the first paragraph. It proceeded vigorously till the 12th August when the animal reached its

Use Cheddar Cheese once a Day.

maximum weight at 160 grammes; this was at the age of about eleven weeks and after it had been on the butter fat for seven weeks. The female rat attained to 170 grammes by the 19th August, *i.e.*, in course of eight weeks under the butter, the excessive weight being due to pregnancy, it gave birth to a litter the next week and dropped to 140 grammes and continued healthy but was thrown out of the experiment.

(3) All the four animals on the *ghee* grew in size and weight. One of the female rats became pregnant and weighed 130 grammes on the 12th August, gave birth to a litter of five young ones on the 18th, but died on the 3rd of the next month. The growth, too, of these rats compared to that of the two butter-fed ones was less vigorous, their weights kept at a low level and it took about four weeks more for the three survivors to attain to the full weight. Their weight at the full growth, however, is the same as that of the butter-fed ones.

7. *Conclusion.*—As the *ghee* diet promoted growth it contained vitamin A. As the basal diet did not contain vitamin it must have been in the *ghee* itself. As the growth was decidedly slower under the *ghee* than under the butter fat the amount of the vitamin in *ghee* was evidently smaller than that in the butter fat. Still it was sufficient to carry through the growth ultimately to the full weight. So unlike the boiled *ghee*, the *kachcha ghee* is fairly rich in vitamin if not quite equivalent to the butter fat.

REFERENCES.

Brahmachari, B. B. (19 2) ... *Indian Medical Gazette*, vol 4 X VII, pp. 309—318.

Drummond, J. C. and Coward, K. H. (19:0) ... *Biochemical Journal*, vol. XIV, p. 661.

McCollem and Simmonds (1918) ... *Journal Biological Chemistry*, vol. II, pp. 33, 55, 104.

Malaria still takes some 2,000,000 lives throughout the world every year.

A recent achievement of the Department of Chemistry of the University of the Philippines is the production of cheese from coconut milk.

The Philippine Islands form an archipelago consisting of over 7,000 islands with a total area of 114,000 square miles, and having a human population of about 12,000,000.

USE CHEESE ONCE A DAY

"To consume at least two pounds of cheese per person per month and as much more as we can sensibly dispose of."

This pledge was signed by every member at a recent farmers' meeting in the U. S. A. All over the State of Wisconsin ways and means are being discussed as to the best method of increasing the consumption of dairy products, and thus bringing prices back to a profitable basis.

How can the consumption of cheese be increased? In India!

We home-makers can serve cheese in some from every day. If we use it at different meals, serve it in various ways, the family will not tire of it, but will form the habit of eating and enjoying more of this healthful, nutritious farm product.

Cheese is a concentrated food, one of the valuable things put up in a small package. A piece of cheese, two inches square and one-third of-an-inch thick, is equal in food-value to a pound of beef.

Cheese should be kept on hand, not purchased in small quantities. Cheese can be bought in so many forms and sizes—soft cottage cheese, cream cheese, cheddar cheese, etc.

No bit of cheese need ever be wasted. It is all food, except for a thin rind. Mold may be prevented by keeping it in a cool place exposed to the light ; near the pantry window is a good place. Evaporation is prevented by the use of paraffine.

When you cut off a week's supply from the large cheese treat the cut surface just as you do the top of your jelly ; shut the air out by pouring hot paraffine over it, it does not dry out unless the paraffine is broken.

The week's supply can be wrapped in paraffined paper, and will be softer and of better flavour if kept at room temperature.

How can cheese be used ? It may be eaten for breakfast in place of bacon, sausage, or eggs, as it can be cut and served in a jiffy when you are hurrying to get the children fed and at school in time on a cold winter morning. Wrapped in oiled paper, you can tuck it away for the noon lunch at school. Some families have become so accustomed to eating cheese with oatmeal or whole grain wheat that these cooked breakfast foods do not taste right unless cheese is eaten with them.

After eating heavy meat dinners during the winter we will feel much better as spring comes on if we occasionally substitute a cheese dish for the meat ordinarily served at noon. This may be maccaroni and cheese, or a potato and cheese dish. The latter may be made as follows :—

A Potato and Cheese Dish.

For every six medium-sized potatoes, pared and cubed, add one small onion finely chopped. Cover with boiling salted water and cook for seven minutes. Drain, put in a buttered baking dish, and pour over two cups of white sauce to which has been added half-a-pound of grated cheese. Season to taste, and bake an hour in a hot oven until the potatoes are soft. The onion may be omitted and chopped pimento added to the white sauce.

To make white or cream sauce used in so many dishes and on vegetables heat two tablespoons of butter until bubbling hot, but not brown. Stir in two tablespoons of flour, add one cup of milk, one half tea spoon of salt and a dash of paprika or pepper. Cook and stir until smooth.

Whenever directions call for grated cheese try using the food chopper instead. Cut the cheese in strips, and use the medium coarse knife. This takes but a few minutes, while grating always seems a tiresome job.

Maccaroni and cheese is a satisfying dish. A good recipe is as follows :—

2 cups maccaroni, in small pieces.
4 tablespoons flour.
4 tablespoons butter.
2 cups milk.
½ lb. cheddar cheese.
1 teaspoonful salt.

Cook the maccaroni or spaghetti in two quarts of boiling salted water until tender. Drain in a strainer and pour cold water over it to prevent the pieces from sticking together. Make a sauce with the flour, butter, milk, and salt. Grate over the top of the dish.

Place the maccaroni in a buttered baking dish in alternate layers with the cheese sauce. Scatter the extra grated cheese over the top with buttered bread crumbs. Bake until the sauce and maccaroni are hot through and the crumbs are brown.

The United States Bureau of Animal Industry estimates that throughout the United States there is only one veterinarian for every 19,000 domestic animals. There are eleven veterinary colleges with a total enrolment of about 1,000 students.

In Russia, where the care of livestock has been neglected in the past, it is reported that the Soviet Government announce that they intend to establish 14 modern veterinary colleges and 67 veterinary research stations and expect some 6,000 students to take veterinary courses.

THE AMERICAN FARMER'S PLIGHT.

C. N. Weisiger.

If it is true that misery loves company the Indian farmer should be somewhat comforted by the condition of his American contemporary, who is, according to a recent article in the *New York Times*,* facing the most serious crisis in that nation's agricultural history. A staggering array of figures reveals that between 1920 and 1930 more than four and one-half lakhs of farm owners lost their farms, farm property values decreased by Rs. 8,000 crores, and tenancy increased by two lakhs.

In popular belief America is the wealthiest nation in the world with little or no economic difficulties, has a greater hoard of gold than any other country, and is squeezing Europe for war debts in order that she may add to her swollen coffers at the expense of debtor nations. But this is not the case. The present depression has thrown more than one crore of labourers out of work, and the backbone industry of the nation, agriculture, is confronted by financial catastrophe.

Nor is the present world-wide crisis more than partly to blame. The figures show that the year 1919 saw the peak of agricultural production in the United States, and that since that time the farmer's position has grown steadily worse. It is now suspected that the industrial depression has its roots in the agricultural collapse. How large a part the cultivator played in the economic life of the country is shown by the fact that "the farmers supplied one-tenth of the manufactured products of the nation, one-eighth of the freight tonnage of the railroad systems, one-half of the exports, one-fifth of the nation's tangible wealth, and one-fifth of the cost of government."

The article goes on to say: "This giant activity in American life, directly affecting fully one-third of its population and indirectly the entire country, is to-day prostrate. The most superficial study of the statistics reveals that while industry reached a new peak of prosperity between 1920 and 1929 the farmer met with one financial set-back after another ; that he was becoming poorer and poorer ; that the disaster of 1920 was followed by an even greater financial catastrophe in 1930. That story can be told simply and graphically by considering the case of Ole Swanson—a case that is not unlike that of hundreds of thousands of other farmers.

"By 1912 Ole, then 35 years old and a renter, had accumulated Rs. 8,000, in cash, two teams of horses, a reasonable supply of implements, a few brood sows, and some cattle. He decided to

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*"The Farmer's Plight." By Bernhard Ostrolenk. *N. Y. Times*, September 25, 1932.

buy his deceased father's farm of 160 acres in Southern Minnesota for Rs. 80,000. He paid Rs. 8,000 in cash, gave a second mortgage to the estate of Rs. 32,000 and a first mortgage to an insurance company of Rs. 40,000.

"Between 1912 and 1920, because of exceptional thrift and competence, Ole was able to pay off the entire second mortgage of Rs. 32,000, besides improving his barns, adding more cattle to his herd, increasing his equipment, building a porch to his home, and making other improvements as well as buying furniture, rugs and books, and giving his children an adequate education.

"But between 1920 and 1928 Ole found that his expenses, because of the industrial prosperity, were increasing. He had to pay more and more for labour and for goods. On the other hand, because of the drop in agricultural prices his income was constantly falling. So in these years he was unable to amortize his remaining mortgage of Rs. 40,000, and, moreover, found that his standard of living was rapidly declining. By 1925 his net income for his personal labour had fallen to less than Rs. 1,600 annually. His 18-year-old daughter, who had become employed in town as a typist, with no experience whatever and without invested capital, was earning Rs. 240 a month. (All money figures are converted from dollars into rupees at the present rate of exchange, or approximately four rupees to the dollar. It must be remembered that Rs. 240 in the United States will not purchase nearly as much in staple commodities as the same amount of money in India), or nearly Rs. 3,200 yearly, almost twice as much as Ole was earning for his labour during that period.

"In 1929 Ole was unable to meet a total interest of Rs. 2,400 and taxes of Rs. 1,200 and was compelled to give the insurance company, holding his mortgage, a chattel mortgage for the interest debt. In 1930 he was compelled to give an even larger chattel mortgage.

"In 1931 his gross income was insufficient to meet either taxes or interest, and the insurance company, now having failed to get interest for three years, foreclosed the mortgage in the spring of 1932. Ole, at the age of 55, was again a renter on his father's farm—the farm upon which he had been born and on which he had laboured for a quarter-of-a-century; having lost his entire equity of Rs. 40,000 he was left carrying a burdensome chattel mortgage.

"Ole's career exemplifies the trend of American agriculture to-day. Not all the farmers have been foreclosed, but all are carrying heavy burdens."

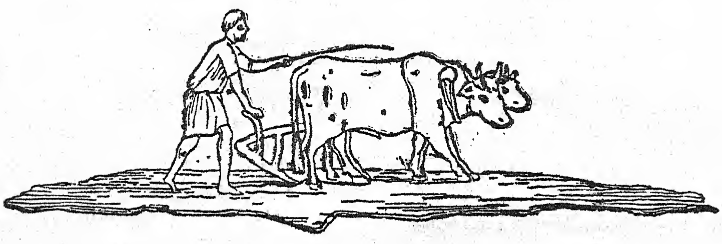
Of the many possible causes of this situation two stand out as being the most important. The first is that the American farmer finds himself unable to compete with the produce of newly-

opened agricultural areas in Canada, the Argentine, and Australia. He is forced to pay high prices for labour, equipment, and building materials because of the tariff on industrial products. America's tariff wall has benefited the industrial magnate at the expense of the cultivator. The second cause is a world-wide factor, namely, the lack of balance between production and consumption. The rapid introduction of agricultural machinery has contributed largely to this lack of balance.

Thus, as a result of the first cause, the farmer's costs of production have risen; as a result of the second cause, the prices which his produce brings have fallen. In this manner he is caught between the scissors of high production costs and low income.

Among the remedies which are suggested for the situation in America are proposals which should interest Indian cultivators. They include a universal cry for a reduction in taxes; re-financing of farm mortgages at lower rates of interest; a general lowering of tariff rates; and the organizing of farmers into large co-operative marketing groups.

The recent political victory of the Democratic party may mean the realization of some of these proposals. Mr. Roosevelt, the President-elect, has stated that he will bend his efforts to re-establish foreign markets by reducing tariff barriers in collaboration with other nations. Both political parties, Republicans and Democrats, seem to favour tax-reduction. The Government's Farm Board has been urging the creation of co-operative market organizations. One thing is certain, in America as in India the time has come when government must shoulder the heaviest responsibility in an attempt to save the farmer from ruin.



Use Cheddar Cheese once a Day.

"UP FROM POVERTY IN RURAL INDIA."

D. SPENCER HATCH, B. SC., M. SC., PH. D.

Directing Rural Demonstration, Travancore and Cochin District. The book contains 204 pages. Published by Oxford University Press. Price, Rs. 2-4-0.

One of the most welcome and practical helps for rural workers in India is the recent book entitled "Up From Poverty in Rural India," by D. Spencer Hatch, B. Sc., M. Sc., Ph. D, of Trivandrum, Travancore, S. India. This book is a treatise on Rural Reconstruction, the most "talked about" subject of the present day. But the contents of the book are not just talk or theory, but are drawn from sixteen years of experience in the field of Rural Reconstruction among the poorest classes of people in India as demonstrated in a Rural Reconstruction Unit at Martandam, Travancore State, S. India. In other words, here is a book telling in simple but effective language about a "Rural Reconstruction Unit" in action. No longer can we rural workers sit idly by saying that we have no guide for proceeding with rural work, or that no demonstration has been made in this field, for here it is before us. It reads like a novel but tells us of a splendid piece of work well done. All we need to do to is read it to get the thrilling story of how the poorest of the poor are being helped to better things through self-help with intimate, expert counsel."

Let us look at some of the fundamental principles laid down in this discussion. First of all, we are told that "The Indian villager is not much benefited unless he is helped simultaneously in very phase of his life, and in regard to every relationship that he bears to others." The work at Martandam, therefore, is comprehensive, helping to benefit all members of rural families, male and female, young and old, different castes and religions, in all phases of their to life-physical, mental, spiritual, social, and economic.

We find that an effort is made to help improve every local product—one by one—and then to help market it. As, for example, poultry-raising is encouraged through breeding for the production of a hen that will produce larger eggs and a greater number than the country hen. Then after the desired egg is produced there is the co-operative effort to market the product so that the villager gets a reasonable price for his product.

Again as another illustration the villagers were producing a kind of sugar from the juice of the toddy palm; but, as they were making it, it was so full of dirt and impurities that they had to accept a low price for it. Through the Demonstration Centre at Martandam this product is being prepared under careful supervision, so that it is turned into a delicious sanitary and

desirable product which is being sold co-operatively through the Centre with profit to the producers.

Thus we see that each vocation of the local area has its product, which through the Centre is improved, and then the people, through co-operative effort and the help of the Centre, is put on the market so that the producers receive reasonable prices for the same.

We are constantly reminded of the aim in all this endeavour which is not to do the thing for villagers, but "that the people themselves shall know how to do all this." The co-operative principle obtains throughout, in that the Centre helps to build up, in the various villages of the area, co-operative societies and clubs and enables them to market their produce as is to the advantage of these village organizations or individuals. This is another of the important principles laid down in this book.

Games and play come in for their share of encouragement. Education through night schools, libraries, extension efforts, etc., also receive great emphasis. Agricultural exhibits, dramas, and other activities are used for the purpose of educating the public to better things.

In these days of economy and shortage of funds it is a great encouragement to know that such an extensive programme can be carried on with a small budget. Reading the book might give a clue to solving the difficult financial problems of Missions during these strenuous times. The fact that local organizations in one hundred villages of Travancore and Cochin are directed by volunteers and honorary workers in itself is a testimony to the effectiveness of a system of training for leadership which should be a great encouragement to all rural workers.

Another most encouraging feature of the Martandam programme is that the matter of training has not been confined to the local area. Since 1926 a Summer Training School of six weeks' duration has been organized which from twenty-five to seventy-five students have attended. These students have been drawn from all parts of India as well as Burma and Ceylon. Thus the spirit which prevails in this comprehensive programme of Martandam can be extended to other rural workers in other parts of India. They have the privilege of studying the programme right on the grounds and can get first-hand experience and see the work going on right before their eyes. What could be more practical or helpful to those who wish to enter this field of endeavour? Thus this has come to be an All-India Training School and seems to be one of the finest services in the work of the Martandam "Rural Reconstruction Unit."

A. S. B. MILLER.

THE IMPROVEMENT OF GOATS IN THE UNITED PROVINCES

A Note on the work done for year 1921-32.

BY A. E. SLATER, B.S.A. AND SIRDAR SINGH BHATIA, I.D.D.

Introduction.—An application from Dr. A. E. Slater to the Imperial Council of Agricultural Research for sanction of a grant of Rs. 40,000 (Rs. 15,000 non-recurring and Rs. 25,000 recurring spread over five years) for a revised scheme for the improvement of goats in the United Provinces was submitted in 1931 and considered by the Imperial Council which, on June 6th, voted to approve a non-recurring grant of Rs. 7,000 and a recurring grant of Rs. 25,000 spread over five years.

The Local Government of the United Provinces made a non-recurring grant of Rs. 2,500 for main goat shed and kidding pens.

The balance of Rs. 5,500 non-recurring was provided by the Mission Poultry Farm by the provision of a house for the assistant manager, an office, dairy and godown, and quarters for four herdsmen.

Lines of Research.—The project calls for four lines of research :—

(*a*) Selective breeding of the best Jumna-Paris by means of recorded milk yields and progeny tests.

(*b*) Selective breeding of the best Bar-bari by means of recorded milk yields and progeny tests.

(*c*) Experimentation with the acclimitization of imported Toggenburg goats to test their suitability for Indian conditions, and to determine whether they will reproduce themselves pure in India without serious loss of vigour.

Recorded milk yields and progeny tests as in (*a*), (*b*) and (*c*) :—

The Plant. (*a*) *Land.*—About 6½ acres of land, which has been fenced with stock-fencing out of Imperial Council Grant, have been provided by the Mission Poultry Farm. Of this about ½ acre is occupied by buildings. Two and one-half trenched acres have been put down to cultivation of guinea grass, napier, and passamuli for fodder. About one acre to lucerne, and 2½ acres to paddocks and kidding pen yards.

(*b*) *Buildings.*—A main goat shed 100′ × 20′ to hold 100 head of adult stock. All *pucca*, with the exception of earthfloor, which needs to be of concrete, but funds did not permit. The interior is divided into 50 stalls, 52 down each side, 4′ wide, each accommodating two.

(c) *Kidding Pens.*—Thirteen in number $8\frac{1}{2}'' \times 6\frac{1}{2}''$ all *pucca*. Each kidding pen provided with a small yard. Earth floors. Four kidding pens accommodate the stock bucks.

(d) Other buildings consist of house for assistant manager, quarters for four herdsmen, office, dairy for milk-recording, and grain godown.

Equipment. (a) *Fencing.*—This consists of stock-fencing around cultivated areas and fencing of paddocks for adult stock and yards for kids.

(b) *Dairy Equipment.*—Consisting of milk cans, strainers, spring weighing balance, measures, complete Gerber test for determining per cent. of fat in milk, and thermometers.

(c) *Office Equipment.*—Consists of desk, almirahs, chairs, records for milk, stock, history ledgers, cultivation, books and periodicals, files and typewriter.

(d) *Miscellaneous.*—Platform scales for weighing stock and chaff-cutter. Thela and bins for grains, castrator, numbered tags, collars and chains, medicines, and surgical supplies.

The Staff.—Consists of Mr. A. E. Slater and his assistant manager and dairy supervisor, Sirdar Singh Bhatia, I.D.D. Mr. Bhatia is an Honour Graduate in Dairying. After graduation he worked as Dairy Supervisor at the Agricultural Institute, Allahabad, for about one year, coming to Etah from that post. I wish to take this opportunity of expressing to Government my appreciation of the faithful and efficient service that he has rendered, and the marked personal interest that he is showing in this project. His services commenced on October 15th, 1931, at a salary of Rs. 100 per month.

The Herd.—Adult breeding stock purchased during the year amounted to 131 as follows:—

Jumna-Paris, 51; Bar-baris 39; Toggenburgs, 11—six being imported from U.S.A., and five from England. Local village goats (*desi*), 20; 10 cross-bred goats were presented by the Mission Poultry Farm free of cost.

Purchase of Jumna-Paris and Bar-baris.—The Veterinary Department of the United Provinces assisted us in the purchase of these. In November and December, 1931, Mr. Slater and Sirdar Singh Bhatia on their advice went to the Etawah District, to Chattarnagar, and personally selected these from about 500 which had been collected from the villages. The highest price paid for a Jumna-Pari was Rs. 25 and the lowest Rs. 12.

Maximum for Bar-bari Rs. 24, minimum Rs. 10. Average price paid for Jumna-Pari Rs. 17 and for Bar-bari Rs. 16.

Local village goats purchased in Etah District at an average of about Rs. 8 each.

The imported Toggenburgs were purchased at an average of about Rs. 306 each, which included ocean freight, crates, feed, and attendance on voyage, railway freight and insurance.

Breed Characteristics.—The Jumna-Paris are a large dual purpose goat, combining meat and milk qualities. They seem to be of Nubian and Egyptian origin, and closely resemble the Nubian goats as bred in England and the U.S.A. Their characteristics are as follows :—

H. S. Holmes Pegler, in his "The Book of the Goat," states :— "The best Indian goats are chiefly the lop-eared type, known as the Jumna-Pari. They closely resemble the Nubian, having, like these, long, wide, pendulous ears, a bow-shaped face, and being tall and leggy. They are said by residents to be splendid milkers, carrying immense udders with big teats. Specimens were at one time brought into this country, having been used on board P. and O. steamers to supply milk to the passengers."

To this description we would add that these goats are not bred to any standard colour or markings : they have a most pronounced Roman nose. Carry a large amount of long and thick hair on the buttocks. The average length of adult males from nose to root of tail is 53″; height from whithers to hoofs, 37″; weight, 155lbs. Females—length, 48″; height, 34″; weight, 110lbs.

Bar-baris.—The Bar-bari is of a dairy type. Their small size renders them unsuitable for meat production. They can be compared with the Jersey cow. Their origin seems to be Africa. H. S. Holmes Pegler, in his book referred to above, calls what clearly appear to be Bar-baris, " the dwarf goat of Guinea."

The "Encyclopædia Britannica" defines Bar-baris as "the dwarf goat or Guinea goat of Central and West Africa, resembles a small English goat in appearance. It is highly resistant to trypanosomiosis. These goats are also found on the Nile, and in Mauritius, Madagascar, and Bourbon.

Our experience would seem to show that these goats give a large amount of milk for their size. They carry large, well-shaped udders. Are short-haired, and have small upright ears, and the facial line is straight. They have the typical dairy wedge shape.

Colonel Olver, C.B., Animal Husbandry Adviser to the Imperial Council of Agricultural Research, wrote in his report dated 9th May, 1932, after his visit of inspection in April, as follows :—

"I was very pleased with the health and appearance of the goats and young stock as a whole, particularly the Jumna-Paris. Evidently the Bar-bari goat is not so hardy, and not likely to be so valuable for open grazing conditions, though a valuable goat for more confined conditions." The average length of the adult male is 40″; height, 37″; weight, 80lbs. Of the adult female—length, 36″; height, 23″; weight, 75lbs.

Toggenburgs.—Quoting again from H. S. Holmes Pegler (the famous English authority on goats) we find the Toggenburgs described as follows:—"In the matter of colour they are uniformly of a light or occasionally rather dark drab, best described as mouse colour, with white or greyish-white markings. There is always a streak on each side of the face right up under the ears down to the muzzle. White is also displayed on each side of the tail, under the body, and sometimes on the ribs, but always on the legs between the thighs, and from the knees downwards. The head is rather long, the facial line being straight, or slightly concave; the eye is full; the ears are of medium size, more or less erect. The neck is long and slender, and there should be always the two tassle-like appendages observable now and again in other breeds. The Toggenburg is nearly always a lean animal, small in bone, of medium size, with a slender neck."

The average length in the male is 54″; height, 36″; weight, 182lbs. In the female—length, 44;″ height, 29″; weight, 130lbs. The Toggenburg is probably the most popular breed of goat in England, in Europe, and in the United States of America. This is due to two important qualities—its great milking capacity and its docile, kindly nature. It is claimed that in Switzerland, Toggenburgs does produce from four to five quarts a day, some of the best even more. A pure-bred doe in California, U. S. A., weighing 160lbs., is credited with the production of 2,096lbs. of milk in ten months. Another doe is credited with producing 2,680lbs. in a lactation period. This doe weighed 136lbs.

The Toggenburg may be claimed to have its equivalent in the Holstein. Seen at a distance they much resemble the females of the black buck familiar to all.

They are claimed to be one of the most prepotent breeds of all, and have been very extensively used in grading up the native stock in the United States of America.

Our imported stock have been secured from Mr. W. L. Te Walt, Secretary of the American Milk Goat Record Association, of Vincennes, Indiana, United States of America, and a famous judge and well-known breeder.

Also from Mrs. A. W. Abbey, likewise a well-known judge and breeder in England. Her address is Downe Hall, Roydon, Essex.

The Kids.—Throughout the year controlled selective breeding has been carefully carried on. Every goat is numbered, and the stud males do not run with the herds, but each female is served when in heat, and a record made.

We have had 117 kids during the year, of which 34 died, and 32 males were sold, leaving an increase of 51 strong, healthy kids.

Feeling. (*a*) *Adult Stock.*—Method followed is as follows :—Stud males confined in paddocks. All females sent out to graze in separate herds, according to breed. Grazing supplemented by green fodder consisting of guinea grass, napier, passamuli and lucerne, also weeds and leaves of trees. Kids kept confined in paddocks till about three months old when allowed to go out to graze. Grain rations are fed morning and evening, while the goats are being milked, the quantity given being determined by the milk yield and size of the animal. The following crushed ration is used, a mixed one consisting of barley, maize, wheat bran, and linseed cake in the following proportions. In very 100lbs. 40 lbs. barley, 25lbs. maize, bran 15lbs., and linseed cake 20lbs. From 6 chittacks (12 ozs.) to 12 chittacks (1½lbs.) is given daily to milking herd. Stud males get 1lb. of grain ration daily, substituting crushed gram (*chana*) for wheat bran.

Dry goats receive about ½lb. daily. Rock salt is available at all times in the paddocks, and crushed salt is fed in the grain ration (3 per cent.).

(*b*) *Kids.*—Receive milk morning and evening, all they can drink. As soon as they show a desire to nibble, dry bran is fed in hoppers and green fodder, as in adults, only more lucerne is fed.

Records.—The following records have been kept :—(*a*) Milk records. (*b*) History and breeding records. (*c*) Feed records (concentrates and fodder.)

(*a*) *Milk Record.*—The ideal method is, of course, separation of the kid at birth, pan, or bottle-feeding of the same, and weighing daily of all the milk produced by the dam. This method is, however, not practicable in India with unskilled labour.

The method followed has been weighing and recording the milk once a week, always on the same day. On this day the kids receive no milk from their mothers, but are hand-fed. The same herdsmen always milk the same goats. The milking always commences at the same time, to give uniform conditions, recording was commenced when the animals purchased started to kid, *i.e.*, in December, 1931. Since most of the goats are still in milk tabulated records are not submitted this year, but will appear in detail in the report of 1932-33, and a comparative statement of milk yield of dams and their progeny will appear in reports for 1934-35 and 1935-36.

Though complete records for the entire lactation are not yet available yet the following figures clearly give some indication of production in the breeds under research.

(*a*) *Jumna-Pari.*—The maximum amount of milk produced in 24 hours by our best Jumna-Pari is 8·4lbs. (Goat No. 45).

(*b*) *Bar-bari* (*Goat No.* 52).—the maximum amount produced in 24 hours is 8lbs.

(*c*) *Toggenburg* (*Goat No.* 94).—The maximum amount produced in 24 hours is 7lbs.

(*d*) *Local Village Goat* (*Desi*) (*Goat No.* 117).—the maximum amount produced in 24 hours is 5lbs.

As regards the Toggenburgs no conclusions can rightly be drawn until these goats are thoroughly acclimitized. The yields produced by their progeny will be the main test. Colonel Olver, in his inspection report, remarked:—"The system of recording milk yield is satisfactory, but the percentage of buttter fat should be tested and recorded to enable the amount of extra feed required to produce the increased milk and butter fat yields obtained by better management, to be accurately tested. Work of this kind has never been done, as far as I am aware for Indian goats, and exact information on these points and as to the comparative feeding value of various locally-produced concentrates should be of considerable value."

We would add that the Gerber test apparatus was purchased in May, 1932, and determination of per cent. of fat, total solids, and specific gravity commenced in June, and will be reported in 1932-33.

(*b*) *History and Breeding Records.*—Contain name of breed; pedigree (this is, of course, not available in purchased goats), date of birth, date of service, number of buck used, date of kidding, number of kids born, weight of kid at birth, date of going dry, yield during lactation, fat per cent., maximum yield of milk daily, average milk yield during lactation, number of days in milk and dry, hospital and illness records.

(*c*) *Feed Records.*—Show daily consumption of each concentrate fed.

Diseases.—From the very commencement of the experiment we have consulted with the Civil Veterinary Department, United Provinces, and sent many *post-mortem* specimens to Captain V. H. C. Hickey, the Director, at his request. We have experienced difficulty owing to the fact that very little research work on diseases of goats has been done in India. We are much indebted to Captain Hickey for his ready assistance and advice.

The commonest diseases we have experienced during the year are pneumonia, specially in kids; a disease locally called Bisi

which, according to Captain Hickey, is as follows. We quote from his letter, dated Febuary 2nd, 1932:—"From what I can gather, and also from the *post-mortem* I carried out while in Etah, that the disease is due to parasitic infection of the stomach, intestines, and liver, and the resulting œdema is, in my opinion, caused by the enlargement of the liver due to chronic hepattitis and resulting in pressure on the portal vein." The following treatment was recommended by him and carried out by us:—

Copper sulphate	...	...	... 2 oz.
Mustard meal (fine) ...		...	... 2 oz.
Water ...	...	...	... 3 gallons.

Well mixed together until the copper sulphate is dissolved. Dosage—full-grown Jumna-Paris 2 oz. of mixture; Bar-bari ½ to 1 oz., according to size and age of adults; kids of all classes ½ to ¼ oz., according to age. Shake well before administering and starve the goats for 12 hours before dosing. The treatment carried out every three months until confident that the parasites have been overcome.

We have noted that the following symptoms invariably occur in this disease (Bisi), which seems to be caused by parasitic infection:—Loses weight. Becomes unthrifty, eats much less, and shows a characteristic swelling under the lower jaw. Has slight fever. In advanced state diarrhœa appears.

The *post-mortem* revealed œdema and other very characteristic conditions, which have already been mentioned. It is most likely that this most prevalent disease, which appeared with us in January, February and March, is caused by infestations of stomach and intestinal worms.

The villagers tell us that the disease is caused by grazing on rank grass growing in low spots and stagnant places. The same disease that we had was very prevalent in the adjacent villages during those months. We were also told that this disease appears only in the winter months, and this was our experience.

Post-mortems revealed most commonly the presence of tape worms, also round worms. An increase in size of gall, bladder, and liver. In most cases the lungs were affected which may be due to the presence of lung worms.

Mortality.—Has been heavy. We have to find suitable and efficient remedies. During the year we have lost 26 adults, this being about 19 per cent. The greatest mortality occurred in Barbaris. In Toggenburgs we lost four out of eleven, this being about 36 per cent.

Stamina seems to be greatest in the local village goats (*desi*), none having died. Jumna-Paris and cross-bred come next, followed by Bar-baris and Toggenburgs.

We would stress the necessity of adequate segregation quarters, at present there being none. Colonel Olver, C. W., remarks:—"In regard to the control of disease it is important that isolation facilities should be increased." It is also important that the floor of the main shed should be *made pucca*. May we quote again from Colonel Olver's inspection report:—"As I explained at the time of my visit it is not possible for this Council to provide funds for the improvement of the buildings and accommodation. I, however, agree that the floor of the main milking shed requires to be made impervious to the extent necessary to insure that urine and fæces can be flushed down and swept out of the building in the channels provided for the purpose at the back of the goats. The amount contributed by the Provincial Government towards the scheme has hitherto been a very small proportion of the whole cost, and it is felt that the Provincial Government should do something to help in this matter. Now that I realize that the shed referred to previously as the main shed is really the milking shed. I feel sure that the position can never be satisfactory until this is done."

Conclusion.—The work of the past year has been largely that of construction of buildings; fencing of cultivated areas and paddocks; planting of fodder crops on trenched land and of trees for shade and fodder; procuring of equipment; purchase of live stock and importation of Toggenburgs. Diagnosis of disease, *post-mortems*, and search for suitable remedies; compilation and printing of necessary ledgers for records. From now on our reports will be of a more technical nature, dealing particularly with the definite research problems in our project.

We feel that we have here a virgin field of great promise. We would point out that whereas both the Government of India, Imperial Council, and Provincial Governments have spent time and very large sums on the improvement of all other kinds of live stock, not forgetting poultry, that almost nothing has yet been done to improve the "Poor man's cow," which is so widely loved and appreciated in Europe, England, and the United States of America, providing as it does on a small quantity of food, a nutritious and plentiful supply of milk for the cottager and humble peasant. It has clearly been demonstrated that from five to seven goats can be kept as cheaply as one cow.

Erosion—And Its Control. By Mr. Mason Vaugh, Agricultural Engineer, Allahabad Agricultural Institute, Allahabad, U. P.

This article will appear in the next number of the "Allahabad Farmer." Lack of space prevented it from being inserted in the present number. Don't miss the next number! Fill up the enclosed subscription blank and mail it without delay.

EXPERIENCE WITH FOWL PEST

(By D. Spencer Hatch, B.Sc.,M.Sc. in Agr., Ph.D.)

Poultry-keepers over wide sections of India have met with tremendous loss and discouragement in the past few years from the serious fowl epidemic which comes with swift violence again and again to both city and village flocks. It has destroyed, perhaps, two-thirds of the best poultry, being more completely fatal to pure bred and improved fowls, but not sparing any kind.

During the period since this violent form of epidemic appeared considerable study and experimentation has been done on the subject. It would seem valuable to give a summary of preventative and treatments which have been tried within my own experience and knowledge. They are given with the sincere hope that they may be helpful. It is my conviction, however, that isolation and strict quarantine will do more than anything else to eliminate this disease. If India is to free itself from diseases of human beings, animals, and birds it must learn the science of segregation. Had not Western countries practised it with thoroughness they would still be troubled with leprosy and small-pox as India still is. Even Germany, with all its scientific genius, has not been able to find a successful innoculation for fowl pest. But the United States has eliminated the disease completely from that country, not by vaccines or cures, but by strict isolation of diseased birds and regulations to prevent movement of birds from disease areas. So, along with preventatives and treatments which may help, and along with trials towards making of a successful vaccine I would recommend proper, immediate, and complete segregation measures.

Preventatives.—There is probably no better preventative than permanganate of potash in the drinking water, using about one-fourth teaspoonful to a gallon of water. Permanganate is cheap and easily obtainable. When disease has attacked a flock each of the birds not affected, which will, of course, be separated from the sick ones, may be given a few permanganate crystals night and morning. This is the preventative measure often given to unaffected persons in a house where human cholera has broken out.

A few drops of tincture of iodine in the drinking water daily may also be used as a preventative.

Dip all the legs of the fowls in tar. Let the tar be warm (not hot). It may be mixed with kerosene oil to make a solution thin enough to penetrate all cracks and crevices in the legs and feet of the fowls.

This treatment, together with giving each fowl as a preventative one drop of C.A.Q. in one teaspoonful of warm water every day, having all drinking water slightly pink with permanganate of potash, and feeding plenty of onions and garlic has seemingly

prevented the disease in several instances where it was raging in compounds all round.

Treatments.—A European resident of South India reports a measure of success in treating fowl cholera. Cases of saving fowls after they actually contracted this disease have been rare. When he found his beautiful birds suffering from this violent epidemic which kills within a few hours, this poultry-keeper made a hasty journey some miles across country to a well-known physician who advised giving the birds pure kerosene. Accordingly five drops were given to each fowl every two hours until the birds either died or got better. This was some trouble, but it resulted in saving a good percentage of the flock. Some birds that were actually stricken with the disease recovered and seem not to have been permanently maimed. This is unusual, for generally if a few birds live they are never of any use. Since this experience several others have found this treatment helpful.

Take ½ oz. pepper, ½ oz. cummin seed (seeragam), 1 or 2 small onions. Thoroughly grind into a paste with curds and make it into a round ball and give with water three times a day. Feed on boiled rice and water only with potassium permanganate and rest the birds for ten days in segregation.

The following is said to have been used with success in Madras. The undermentioned amounts according to price are mixed together:—

		Rs.	A.	P.
1.	Dried ginger	0	0	6
2.	Vasambu	0	0	6
3.	Asafœtida	0	2	6
4.	Omum	0	0	6
5.	Seeragam	0	0	3
6.	Pepper	0	2	0
7.	Mustard	0	1	0
8.	Saffron	0	0	6
9.	Chillies	0	1	0
10.	Podutbala keerai	0	2	0
11.	Garlic	0	1	0

All are ground up on a curry stone, mixed to a paste, and given in balls. As a general tonic and preventative a ball the size of the little finger from tip down to nail root to every chicken each morning. For a sick fowl a ball the size of the tip down to nail root repeated in the afternoon.

The Poultry Department of the *Times of Ceylon* gives the following as a preventative and says that it has been used very

Use Cheddar Cheese Once a Day.

effectively during the Ceylon epidemic when the disease was raging all round:—

Zinc sulphocarbolate				30 grains.
Calcium	do	...	...	15 ,,
Sodium	do	...	...	15 ,,

The whole to be mixed in two quarts of water, 80 ozs., and use full strength as drinking water.

The calcium sulphocarbolate is difficult to get. If it cannot be obtained the same amount of the sodium equivalent may be used, making 15 grains each of the zinc and sodium sulphocarbolates to each quart (40 ozs.) of water.

The strength given is for times when the epidemic is near. At ordinary times half as much water again is added and used as a preventative.

Mrs. Fawkes, Poultry Expert to the United Provinces Government, used and recommends the following for cholera:—

"Take flowers of sulphur 4 oz., powdered charcoal 2 oz., pulverised rhubarb 1½ oz., carbonate of iron 4 oz., golden seal ½ oz., pulverised opium ¼ oz., mix and make into pills the size of a pea with a little *ghee* or treacle or put one teaspoonful of powder into the mash for 12 hens. Keep in air-tight tins."

Both turkeys and hens seriously stricken with the disease have recovered when given C.A.Q. They should be treated immediately they are attacked. Experiments had to be made to find the right quantity. When three drops were given as a dose the birds died seemingly partly from the medicine. One drop in a teaspoonful of water four times a day seems to be the most effective treatment.

This treatment we find to be more effective when the mouth and stomach is rinsed out before the C.A.Q. is given. This is done by holding the fowl's neck extended upward and pouring in as much lukewarm water as possible through the mouth. Then hold the bird with head downward and by manipulating and softening the crop with the hand cause all the water and as much of the foul matter within to run out.

A fountain pen filler is about the most convenient instrument with which to get all the liquid well down into the fowl's throat. The mixture C.A.Q. is easily available, ready prepared at chemist shops.

A poultry-keeper who has had much sad experience with this fowl pest reports finding the following treatment such a success that during the last attacks in her poultry yard she has had no fatalities and is able to say "The disease has no longer any terrors for me"

Prevention.—Dose for every fowl once or twice a week during exposure to infection. (One teaspoon C.A.Q. in $\frac{1}{2}$ cup water), one teaspoon of mixture to each fowl. Dry chunam sprinkled over ground in hen houses. Permanganate in water.

Cure.—Dose—(One teaspoon C.A.Q. in $\frac{1}{2}$ cup water), one teaspoon of mixture to sick fowl three or four times a day—and alternate with feeds of crumbled bread and chopped egg (and garlic when fowl is improving) washed down with milk. The fowl must be hand-fed if she is too weak to peck. It is essential to keep her strength up. Keep her in a warm, dry place, on dry straw out of a draught.

Making a Vaccine.—Kill a chicken which is suffering badly with the disease. Take out liver under strictly aseptic precautions. Get a doctor to help. Make 1 per cent. solution or emulsion as follows:—Cut up liver, pound it into fine pieces. Put this in 0.9 solution of common salt (make salt solution first—then put in liver particle). Make large quantity. Heat it to 60 degrees centigrade on three successive days for one hour. (Put it in water at that temperature and keep it so.) Then at the end of three days add $\frac{1}{2}$ per cent. of carbolic acid pure. Keep it one day, then it is ready. Dose will be $\frac{1}{2}$ c.c., *i.e.*, about 7 drops for adult fowl. Inject in leg (inner side where there are no feathers). Repeat after one week.

The "Wah-Wah" Plough.—An introductory note to appear in the next number on certain features of an improved plough recently developed by the Agricultural Engineering Department of the Allahabad Agricultural Institute, Allahabad, U. P.

This article alone will be worth the price of a whole year's subscription to you. Do not miss it. Be sure your name is on our subscription list in order to avoid delay in receiving your copy.

Use Cheddar Cheese
Once a Day.

A NOTE ON THE PREPARATION OF DAHI WITH A LACTIC ACID PRODUCING FERMENT

Curdled milk is known by various names all over India, and it is a common and valuable article of diet. The common name in the U. P. is "Dahi"

Dhai as purchased in the bazaar, however, may be very impure, and contain a number of micro-organisms quite capable of neutralizing much of the benefit that may be expected to accrue from the use of pure "Dahi"

Under general domestic conditions in India the preparation of "Dahi" by transferring a portion of one day's curdled milk to fresh milk for next day's use is not to be entirely recommended. For it is doubtful whether after three such transferences, a safe and reliable product could be guaranteed on account of contamination.

In large centres it is much better to have the article prepared at a central station and distributed in properly protected vessels, ready for consumption. In up-country stations a regular supply of tubes of ferment should be obtained and a fresh tube used every week or third day.

Good results cannot be expected from the various tablets and powdered preparations on the market, whether they are intended for direct consumption or for the preparation of curdled milk.

The organism found in curdled milk all over India is the Streptothrix Dadhi (Chatterjee). THE AGRICULTURAL INSTITUTE, ALLAHABAD, has recently secured a strain of Bacillus Bulgaricus, and are able to issue the same now. The B. Bulgaricus organism produces a curdled milk that is slightly more acid than that produced by the Streptothrix Dadhi organism. Bulgaricus milk is widely used in all parts of the world on account of its therapeutic values. A course of treatment with Bulgaricus milk will keep the intestines and digestive system in good order, relieve cases of chronic and acute constipation, and other intestinal disturbances.

Good results have been secured by the Dairy Department, of the Agricultural Institute, Allahabad, with both pure cows' and buffaloes' milk. The milk in any case should be of the highest quality, derived from cleanly and carefully fed and well cared for animals. When cows' milk from the Agricultural Institute Dairy is not available, buffaloes' milk may be used. Dahi from cows' milk is now available from the Agricultural Institute Dairy, delivered daily to all parts of the City and Civil Lines of Allahabad, in sealed containers at 8 annas a seer. Pure cultures in

sterile test tubes plugged with parafinned corks are also available suitable for one week's use in the winter season and 3 days' use in propagation in the summer season, at 3 annas per tube.

Directions for the use of pure Culture Tubes of the Ferment for Producing the Purest and Best Quality Dahi for use in the Home

The optimum temperature at which the organism B. Bulgaricus can be propagated is 104° Fahrenheit. When no thermometer is available this temperature can be fairly accurately gauged by the hand on the outside of the vessel, it should feel definitely warm, but not in the least degree hot. If there is the least desire to withdraw the hand after a minute's application it is still too warm. In order to maintain a temperature of 104° F. some form of incubator is desirable. This can be easily improvised without much cost. Take two biscuit tins, both with lids, of such a size that the smaller will go into the bigger one, leaving one inch air space all round. The smaller box is supported in the larger box by four small corner baked clay-blocks. It can be further steadied in position by means of cork or other non-heat-conducting plugs glued to the sides and top. Heating can be done by a small stove or burner. Experience will show the size of the flame, or height of the box above the flame necessary in order to maintain an even temperature of 104° F. in the inner box when both lids are closed.

The milk should be boiled or steamed in the covered vessels in which it is to be fermented. The inner vessel should not be filled more than 2-3rd full of milk. After being steamed for twenty minutes, or preferably boiled for two or three minutes, the milk is set aside to cool down to the requisite temperature, always keeping the vessels carefully covered. When the milk is cooled down to 104° F. it should feel definitely warm, but not in the least degree hot. The next step is to add and stir in the ferment from the sealed tube, which must be done with special precautions, as follows :—Holding the test tube horizontally with the left finger and thumb draw out the cork. Now twisting the tube around pass the lip of it several times through the flame of a spirit lamp to burn off any dust adhering to it. With a suitable stirrer (an ordinary steel knitting needle will do excellently) break up the curd thoroughly. The needle held in the right hand should have been previously passed through the flame once or twice and allowed to cool without touching anything. During all these operations the tube of ferment has been held horizontally. Now transfer the ferment tube to the right hand, and, lifting off the lids of the milk vessels for as short a time and distance in as vertical a direction as possible, pour the ferment in. Each tube is sufficient for

half a-seer of milk which may be conveniently distributed in two covered dekchies.

Having added the ferment to the milk it should be thoroughly stirred in, and this should be done with a spoon just withdrawn from a jug or pan of boiling water. The dekchies or the original container is then placed in the improvised incubator and kept there till the milk is thoroughly curdled. This takes 12 to 15 hours. It should then be removed and kept cool or iced until used, which should be within 24 hours after withdrawal from the incubator. It is much more appetizing when cool.

Good Dahi should be evenly curdled and of good consistency. The cream may separate out as a layer on top and there may be a thin layer of clear whey. Excessive separation of whey may be due to fermenting too long at 104° F. or to a wrong ferment having got in. In no case should there be gas bubbles in the curd. Such are always caused by a wrong Ferment having gotten in.

Scrupulous cleanliness should be exercised throughout, and all vessels, spoons, stirrers, dekchies, etc., should be scalded or passed through a flame just before use. When these manipulations are carried out the lactic acid producing organism will get a good start and will inhibit to a great extent the growth of less undesirable organisms. Good Dahi in the same way will give a good start for growth of these organisms in the intestinal canal.

When the Dahi is ready for use a propagation for the next day's supply can be made. This is done by preparing the milk as explained above, and by transferring one tablespoonful of Dahi to one pint of milk after the spoon has been scalded and cooled down. This sort of propagation may be continued for one week in the winter and three days in the summer months, when a fresh tube of the pure lactic acid ferment should be used again, otherwise the dahi will become heavily contaminated with undesirable organisms and the value of the Dahi greatly reduced.

Dahi can be recommended for breast-fed infants only when the Dahi is of the purest quality and at the instance of doctor's prescription for the same. When pure, Dahi is an ideal food for improving the thriftiness and growth of unthrifty children.

For adults of all ages, and invalids, pure Dahi is an ideal food. The literature abounds with striking testimonies of the value of this fermented milk product. It is particularly fortunate that the consumption of Dahi enjoys such a wide vogue in India. It is also regrettable that suitable agencies have not been established up to the present time to cope with the need for a pure commercial product. The Agricultural Institute Dairy, Allahabad, in putting on the market both pure Dahi and pure cultures of Dahi in tubes for propagation is meeting a long-felt need. It is hoped that the public will show its appreciation by its patronage of these highly valuable food products now available.

RURAL UPLIFT

IN ALLAHABAD DISTRICT.

It is well known that in India there are over 250,000,000 persons living on agriculture, and yet one can safely say that no industry has been so badly neglected as agriculture.

Please look at the way Russia—which, like India, has an enormous agricultural population—is trying to re-organise her agriculture. Anyone who visits Russia cannot but be impressed by the huge sum of money the Soviet Government is spending on science. Soviet Russia is, at present, a poor country; but her expenditure in the direction compares favourably with that of rich countries like America and Great Britain. She probably spends a much greater percentage of her surplus wealth on science than any other country. For instance, she spends Rs. 4,500,000 a year on research in Applied Botany. An experimental electrical laboratory is being constructed in Moscow at a cost of Rs. 22,500,000. If Soviet Russia can make such efforts when she is still poor why not India ?

The Allahabad Agricultural Association was founded in the year 1927 at Allahabad for the development of agriculture in Allahabad district as agriculture is the chief industry of the district. Since then it held six Agricultural and Industrial Exhibitions every year in the Magh Mela. Two years it held 76 travelling agricultural exhibitions and demonstrations for the development of agriculture in the various tahsils of Allahabad district. The success of the last Kumbh Mela exhibition is well known to all. It was visited by the present H. E. the Governor, who was favourably impressed, and remarked that this exhibition ought to expand.

The Allahabad Agricultural Association moved Maharao Raja Ram Singh, the then Chairman of the District Board, Allahabad, for the conversion of the compounds of the District Board schools into demonstration farms. This suggestion was approved by him, and a circular was issued by him to give effect to the above scheme. But it is a great pity that apparently it did not get enthusiastic response from the various members of the District Board staff.

Subsequently the Association moved the Hon'ble Raja Bahadur Kushalpal Singh, the then Minister of Agriculture, to get a training class opened for the 72 Hindu Sabha Pathshalas for subsidising the Agricultural and Co-operative Department of Allahabad district for agricultural development and starting better living and better farming societies free of any rucurring charge. The Minister was good enough to sanction a grant of Rs. 1,000 for the

Use Cheddar Cheese Once a Day.

training class. A training class for training 60 Hindu Sabha teachers was opened in the Agricultural College, Allahabad, for a month from 1st June, 1930. These 60 teachers, after getting elementary training in the various subjects, help in the rural uplift after their school hours. In some places they have succeeded in persuading the villagers to construct a school building by subscription, formation of Panchayats which settled many disputes in the village and thus saved them from litigation, and persuaded them to get their cattle injected, etc., when there was an epidemic and helped in the introduction of better seeds and sugarcane-growing, etc.

I regret that on account of political atmosphere in the Allahabad district during the last two years much could not be done as was expected from these teachers after the above training class. I expect better results when normal conditions restore in the district.

India, like Russia, is predominantly an agricultural country, and much attention must be given to India's agricultural development. No doubt, we have now a few agricultural colleges scattered here and there, a few provincial departments of agriculture, and also an Agricultural Research Council. We are very thankful for these. But our agricultural colleges train men, like other departments of Education, for jobs, and hence they have been signal failures in reaching the unit farmer. Our agricultural departments are spending more money in perpetuating their own existence than in striving to place scientific agricultural knowledge in possession of the cultivators. Our Agricultural Council is placed mostly in the hands of distinguished and high-salaried statesmen, most of whom have little knowledge of our farmers, their needs and requirements. We need scientists, not the type that helps to swell the army of educated unemployed, but such as can apply the knowledge acquired to the solution of the problem of agricultural India. We need research scientists and agricultural chemists to find out how India can improve what she has and increase her production through the application of science. We need to spend less on departments and more on Applied Science. In this respect we must turn to America and Russia for ideas and inspiration.

Considering the utility of the elementary training given in various subjects to pupil teachers of the Hindu Sabha Pathshalas in Allahabad district aided by the District Board, at the Agricultural College at Allahabad, in June, 1930, and, with a view to give elementary training in as many subjects as possible to all the teachers of the District Board schools of Allahabad district, it seems advisable to adopt the following scheme for the training :—

Scheme for the Training of the Allahabad District Board School Teachers in Agriculture, etc.

Under the District Board of Allahabad there are 836 schools with about 1,600 teachers.

1. With a view that the work of the school may not suffer it is suggested that half the number of the teachers of such schools, in which there are more than one teacher, one teacher may be deputed to the training class which will be opened in each tahsil.

2. There are eight tahsils in the District of Allahabad. It will be necessary to open a training class in each tahsil for a fortnight or a week at least, so that 50 per cent. of the teachers may get training in Agriculture, etc., as as detailed below:—

LECTURES.

1.	Agriculture	...	10	to	11 a.m.
2.	Cattle-breeding	...	11	to	11-50 a.m.
3.	Veterinary	...	11-50	to	12-40 p.m.
4.	Co-operative	...	12-40	to	1-30 p.m.
5.	Sanitation and Hygiene	...	1-30	to	2-20 p.m.
6.	Physical Culture	...	2-20	to	3-10 p.m.
7.	Method of Teaching	...	3-10	to	4-00 p.m.

Lectures in all the above subjects will be delivered daily for a fortnight, or at least for six days in a week, from Monday to Saturday. Sunday will be spent in transit. Thus it will be seen that 13 or 6 lectures in each subject will have to be delivered in the training class.

3. If it is considered necessary that all the teachers of a tahsil may be trained before the training class is opened in another tahsil, in that case it will be necessary to have the training class in a tahsil for a month or two weeks together so that all the teachers may be trained.

4. It is suggested that an allowance of *annas eight* per day may be given to teachers for their food and Re. 1 for transit charges. In this way for training 50% of the teachers (if the class is held for a fortnight) in the first year it will be necessary to provide Rs. 6,400. Half of this amount should be met from the District Board funds and half should be provided by the Government. If for any reason the District Board cannot provide funds for the above purpose the total charge will have to be provided by the Government. According to the above calculation all 1,600 teachers of the Allahabad District Board can be trained in eight months at a cost of Rs. 12,800. These teachers,

when thus trained, will be of great help in the rural uplift of the district.

5. The Head of each Department mentioned above will have to be moved with a view to depute, for the above period, a suitable member of his staff, who may be able to deliver lectures in their various subjects, aided with a magic lantern if possible.

6. The training class will be held at the Tahsil School in each tahsil where the teachers will have to be accommodated. The number of teachers in each class will be about 100. If the training class is held during the summer vacation the school work will not suffer.

If it is not considered advisable to train all the teachers of the district at a time I would suggest first to train all teachers in one tahsil. There are about 1,600 teachers in eight tahsils in Allahabad district; hence on an average there will be about 200 teachers in a tahsil. The amount of their allowance also will be proportionately reduced to Rs. 1,600 only.

If there be any difficulty in holding the training class in a tahsil it will be possible to open the class, with the permission of the Authorities, in the Agricultural Institute, Allahabad, from the 1st June, when the Agricultural College and the District Board Schools are closed for the summer vacation.

The present Chairman of the Education Committee of the District Board and the Deputy Inspector of Schools, Allahabad, both were approached by me on the subject on the 17th April, 1932. Both the gentlemen are willing to co-operate in the above scheme provided it is sanctioned by the Authorities concerned.

In case, on account of the present financial stringency, there be some difficulty in finding funds for the proposed training class, then, though there will be some hardship on the teachers, the question of allowance to teachers may be dropped and some provision may be made for the miscellaneous contingencies, etc., for the proposed training class either by the District Board from its own funds or some grant may be sanctioned by the Government to the Allahabad District Board for the purpose.

If this scheme proves successful in Allahabad district then it can be tried in other districts of the provinces, and thus from this province to the various other provinces of India. In this way it will be seen that the teachers and taught both will be benefited and will be able, to some extent, to help in the rural uplift of the province, which is so far very much neglected and needs immediate attention from all concerned. If the departments concerned like they may have a set of elementary lectures printed for the above purpose.

It will be seen that the proposed scheme is very economical, indeed; and, in spite of the present financial stringency, effect can

be given to this immediately. It will go a long way to re-organise agriculture, which is the chief industry of our country, and thus it will help, to a great extent, in solving the problem of unemployment in India.

MOOLCHAND MALAVIYIA,
Honorary Secretary,
Allahabad Agricultural Association.

Dated 10-11-'32.

MANUFACTURE OF INDIAN SWEETS

BY N. R. JOSHI.

Gulabjamun from Chhana.

PREPARATION No. 1.

Take one pound of fresh *khoya* and add to it about 2 ozs. of water. Knead it thoroughly so that all the lumps are broken. Then take one pound of *chhana* (for the preparation of *chhana* refer to our article on "Manufacture of Indian Sweets" in Vol. VI, No. 3) and mix it with *khoya*. The whole thing should be kneaded so thoroughly that it should form into a homogeneous mass of smooth consistency. Make small egg-shaped balls from this and keep them. Now get your syrup ready. (The preparation of syrup is the same as given in the article referred to above). After the syrup is prepared put a frying pan on the fire with about two lbs. of good-flavoured *ghee*. Fry your balls of *chhana* in this *ghee*. The frying should be done on a very slow fire, and very gradually, so that the *ghee* penetrates through the ball. Rapid frying will allow a thick crust to be formed on the outside and then the *ghee* will not soak through so nicely. The frying should be continued till the balls become brown. These balls are then removed from the pan and put into the syrup. If the frying is done rapidly then the balls will dimple as soon as they are put into the syrup, but if the frying is done thoroughly then they will soak well in the syrup. After allowing them to soak in the syrup for two to three hours they are ready for use.

PREPARATION No. 2.

Instead of adding *khoya* add about 4 ozs. of wheat flour (*maida*) to *chhana* and then prepare in the same way as above.

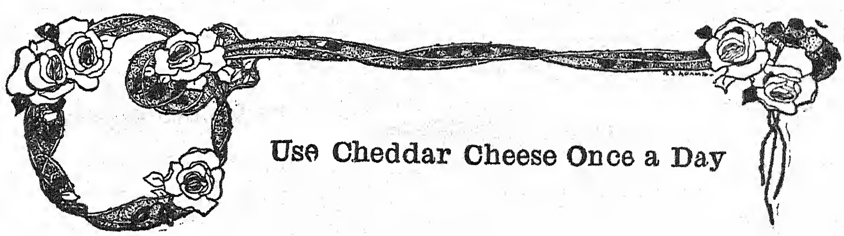
Preparation No. 3.

Instead of adding *khoya* finely kneaded mash of boiled potatoes may be added. Take ½lb. of potato mash for one lb. of *chhana*. The frying in this case should be done very cautiously, otherwise the balls may break in the *ghee*.

Sandesh.

Take fresh cow's milk and put it on fire. The milk must be of good flavour. When the milk begins boiling take it down and put in either 4 to 8 ozs. of old whey or 1 to 2 ozs. clean alum powder. As soon as the milk solids begin precipitating pour the whole thing over a clean piece of muslin cloth so that the whey may run out. Allow the whey to drain out for some time. Weigh the *chhana* and mix in it an equal quantity of powdered crystal sugar. Knead it a little so that the sugar is mixed uniformly. Now put it on a slow fire. Keep stirring and kneading with a wooden paddle till all the moisture is driven out. Care must be taken that the sugar does not get carmalized on account of too much heat. When the *chhana* with the sugar becomes a uniform mass of smooth consistency take it down from the fire. When it has cooled off put in some flavouring material. Either *keora* or rose essence give a good flavour. Then spread the whole mass in a dish and sprinkle some finely-cut pistachio nuts on the top. Cut it into small cubes, and it is ready for use.

Your attention is invited, and your co-operation is solicited, to our drive for increased subscribers in this year, 1933. Tear out the perforated blank to be found in the Editorial section, fill it up; and return it without delay. Thank you !



WANDERINGS OF AN ALLAHABAD AGRICULTURIST

By B. M. Pugh.

The following is an account of the impressions made on the writer's mind while on his visit during the last *Dasehra* holidays to some of the farms and colleges here in this country:—

Leaving Allahabad on the 2nd October I arrived at Jubbulpore the next morning, where I visited the Adhartal Farm, which is one of the Government farms in that city. Some of the crops grown on this farm are rice, sugarcane, ground-nuts, turmeric, ginger, etc. There were two varieties of rice grown on this farm. The first is *chhatri*, a late variety but one which grows well and gives high yields. This is a very common variety in the Jubbulpore district. Another variety which I saw on this farm is called Paddy 17. It is an early variety. So this variety allows for double-cropping on the farm. But the variety is coarse, and not as good as *chhatri*. Another variety, which is popular with the local farmers, is *dilbuxa* which, however, is not grown on this farm.

The variety of sugarcane grown on this farm is Co. No. 237. This is a thin cane variety, but it stands well and does not lodge. It produces a yellow, brown *gur* which is a desired colour. The other varieties that are grown in districts south of Jubbulpore are Co. 217 and Co. 290.

Two varieties of peanuts are grown on this farm, the Spanish and the Small Japan. Both of these seem to do well on this farm, although the soil does not seem to be good, as it is too light and gravelly in most places.

Turmeric and ginger are more or less regarded as new crops in the district. The acreage under these crops is increasing, which seems to indicate that the growing of these crops is profitable.

The soils on this farm are mostly of a reddish brown colour. This seems to be the type of soil prevailing in this province. The red colour seems to increase in soils which lie closer to the hills, like those near Gondia. Rice, however, seems to do well on this soil, and does not lodge as much as in the United Provinces. Perhaps this is due to the variety of rice grown or to the lack of nitrogen in the soil which makes the stems of the plant stiff! As one approaches Nagpore, however, the soil gets darker and darker in colour until at Nagpore one comes across the famous "black cotton soil" on which mostly cotton is grown.

At Nagpore I visited the Nagpore Agricultural College, where I was first taken to the Soil Physics Department. Here several pieces of apparatus had been set up by the students in a more or less spectacular fashion. I then went through the library and the museum where seeds were properly arranged. While in the museum my attention was drawn particularly to two wheat varieties, *hawrat* and *julalia*. *Julalia* is the earlier variety of the two.

The next day I visited the cotton fields, where several varieties of cotton were being tried out. There were varieties of Gossypium indicum, G. neglectum, and G. hirsutum. Verum 262, a variety of G. indicum, is claimed to be the best and the most successful in the Central Provinces. This variety was arrived at through field selection. However there was a great deal of hybridisation work being carried out on this farm.

I next visited the rice-fields. Among the varieties grown on this farm are Chinoor, Gurmatia, Bhatagurmatia, Luchai, and Bhondu. Of these five Bhatagurmatia is the earliest variety, and Bhondu the highest yielder.

I was then taken around to the Arhar or Juar (Cajanus indicus) fields. The leading and most popular variety is Tuar No. 3, which is now under trial for resistance to blight. A strain was being selected which would also be able to resist blight. There were 36 types of Tuar in the botanical plots there. Mung and Urid (Phaseolus Mungo and Phaseolus Aureus) were the next crops that I visited. In the fodder plots I was surprised to find a species of Abysicarpus (Shevri or Shevra), a common weed, perhaps Abysicarpus Vaginolis being grown for trial as a fodder. Andropogan purpureo crisios was another grass among the fodders. Velvet bean was still another.

I then proceeded to the Juar (Sorghum) fields. Here Ramkel Juar was mostly grown. This is a later variety than Sundhia jowar. But Sundhia jowar is not preferred on this farm because it matures in September when fodder is not needed. The rotation on the jowar fields practised on this farm is cotton followed by jowar, then cotton, jowar, cotton, and Tuar (or Arhar) the sixth year.

From Nagpore I went to Poona. Here the Agricultural College Farm is about 300 acres, and practically all of it was being used for educational purposes. In the first field that I was taken to about a row of each of the different varieties of the crops found in the province were being grown. Just to name a few of them, for instance, there was one line of each of the following jowars—Sundhia, Chapti, Perio, Nibalo, Gidgap, Aispuri, Gudghi, Solapuri, Nilwa, etc. There was one line of each of the following varieties of ground-nuts—Pondicheri, Big Japan, Small Japan, and the Spanish peanut. There were the following varieties of cotton—Ghogari, Surat, then Wagad and Kumtha of the varieties of G. herbaceum, then Dharwar, American, and Cambodia among the varieties of G. hirsutum, then Bauni (G. indicum), then Coriulla, a variety of G. cernum. Even buckwheat and jute were also grown in these lines.

The gentleman who took me around spoke very highly of two or three crops which are not commonly grown in the United Provinces but grown to a great extent in other parts of India.

One of them was Suran (Amorphophilus Campanulatus.) This crop is sown in May, and then irrigated, so that it sprouts before the heavy rain sets in. Another crop is Tapioca. This is also a drought-resistant plant and grows well on the College farm. It is also sown at the beginning of the monsoon.

The third was the yams. He claims that the yield from one plant is about 10lbs.

On this Farm two types of tobacco were being grown: (1) Gondia No. 6 and (2) Satara.

The sugarcane varieties that seem to do well on this Farm are the P. O. J. and Co. 290. Wherever jowar is grown on this Farm it is always followed by groundnuts.

From Poona I went to Baroda, where I visited the State Model Farm. This Farm has about 82 acres of land on which cotton, bajra, peanuts, and fruit trees of various kinds are being grown. The cotton variety that was being grown on this Farm was Broach No. 9. This was suffering very badly from root-rot, a disease similar to cotton wilt (Fusarium.) This Broach cotton has a longer staple than Bauni (G. indicum.)

The main crops in the State of Baroda seem to be cotton, bajra, rice, and arhar. The soils of Baroda are mostly alluvial, but very gravelly in most places that I passed through. Near Dohad there are spots of black cotton soils, but here the land is undulating and residual soils are predominant, which are the decomposed material of the rock from which the hills are made of.

From Baroda I wandered on to Indore, where I visited the Institute of Plant Industry. In this farm the crops and even the experiments, that are being conducted in the field are very similar to those at Nagpore. There is the same hybridization and selection of cotton. From this work Indore No. 1 and Indore No. 25, two cotton varieties, were produced which are recommended to the cultivators of the Central India States. However, the types are not fixed yet, but there are already signs of the deterioration of the crop due to the result of inbreeding.

The Akola and Spanish varieties of peanuts are also being grown on this farm. The Akola varieties seem to do better than the Spanish ones.

Some experiments are being conducted this year with the making of silage by piling cut fodder on the surface of the ground and plastering it with mud all around, making the pile into a more or less air-tight mound. The idea in doing this is to avoid the seepage of water into a silo-pit, which is a common feature in this part of the country. The making of manure by a method of composting barnyard manure and the bedding from the barns is another feature of this farm.

The sugarcane varieties grown on this farm are S. 48, Co. 213,

Co. 290, etc. S. 48 seems to be the best on this Farm, and has not yet been attacked by Mosaic disease, which is so prevalent on this cane in the United Provinces.

The country round about Indore would seem to me to be very suitable for fruit culture. But I was surprised to find that no work was being done in the Plant Service Institute for the propagation of the fruit industry in the States.

Leaving Indore I went on to Ujjain. The State farm at Ujjain consists of about 150 acres of land. This is one of the two State farms in the Gwalior State, the other one being at Gwalior. The main object in keeping up this farm is to produce seeds of the varieties of crops recommended to the farmers in the State. On this farm Ramkel and Scindhia jowars are grown. Besides these there was also White Bandhel jowar and another yellow variety selected out of the local ones. Gram was also being sown at the time when I visited the farm. Malida gram, they claim, is the best. Kabuli gram is good for a year or so, but it quickly deteriorates on this farm. A yellow variety of gram selected out of the local ones, they claim, will stand the unfavourable conditions in the field better.

Of the cottons Cambodia, a variety of G. hirsutum, was being grown and seems to do well. The varieties selected by the crop botanist on the farm, however, seem to be the best under their conditions. These were strains of the Malwi variety. Verner 262 was also being grown, but it does not do so well as the locally selected ones.

Of the sugarcanes a variety called Paunda or Paudiya seems to be the best. This is a chewing variety, and the demand for it in the market is also very great.

Leaving Ujjain I came to Bhopal, Jhansi, and Cawnpore. In the last place I visited the Agricultural College Farm and also the Research Farm. On the College Farm Paunda, Co. 281, and Co. 283 are some of the sugarcane varieties grown, and also the newer Coimbatore varieties, Co. 352, Co. 353, and Co. 355. Among the cotton varieties grown on this Farm and recommended by the Cawnpore authorities to the local farmers are Cottons No. 402 and No. 520 and Aligarh No. 19. The first two are the products of selection and hybridization carried on in the Research Farm, and they are at present the most leading varieties in the district.

From Cawnpore I returned to Allahabad.

In a brief article like this it is not possible to put down all that I would like to. I have only mentioned certain things which I came across which may be of immediate interest to the farmer. In many of these places I was also able to spend only a day or half-a-day, so that in going through these places rapidly there are many things going on at these farms that have been overlooked.

METHODS OF CATTLE IMPROVEMENT IN INDIA

By Sudhir C. Chowdhury

India is an agricultural country, and cattle are the main support of her agriculture. Indian agriculture is so closely connected with cattle that it is almost impossible to perform a single operation on the farm without their help. Moreover, in India the cow is held in veneration by the Hindu community, and the whole of the people, whether Hindu, Mahomedan, Sikh or Christian, look to her for part of their food-supply in the form of milk, *ghee*, or other by-products. But in spite of this importance of cattle in India the majority of the Indian breeds of cattle are of an extremely low grade and in extremely poor condition. The bullocks do not pay for their keep through the work they perform, and the cows do not pay for their keep through the milk and the offspring they give. In the case of Indian cows "a good average is 5lbs. a day or 750lbs. per lactation, and it is well known that a cow must give 1,250lbs. milk per annum, which, if sold at two annas per lb., makes it worth while keeping her." Hardly five per cent. of our cattle are in good condition and can be ranked with the cattle of other countries. The majority are of such poor quality that they would not be allowed to live in any other country. From the economic point of view they are a burden to the country. Some millions of cattle, good for nothing, are maintained in the country simply because we Indians venerate the cow and *lack proper dairy education.* India spends about sixty crores of rupees annually to feed worthless cattle. What a great waste it is for a poor country like India!

The most important causes of the deterioration of our cattle have been want of proper care, lack of good breeding, shortage of fodder, and an indifference to weeding the worthless cattle on the part of the people. As regards the first, the farmer cannot be blamed. A farmer can have no incentive to take better care of an animal which barely gives him 5lbs. of milk per day during her lactation period and bears a lame or lazy calf. If he has better animals I am sure he is shrewd enough to understand that it will pay him to take better care of them, and experience shows that he actually does so.

The problem of breeding our stock cannot be solved by the farmer himself. India possesses the largest number of cattle in the world, but she is very poor in her breeds. It is lack of knowledge and experience which is mainly responsible for this. The best milking breeds of Indian cattle are found in the Punjab, Bombay and Madras, and these are the results of careful breeding and rearing. Such breeds are the Scindhi or Red Karachi, Kankrej, Nellore, Harriana, Goe, Sahiwal, and Tharparkar which have been

evolved by the nomadic people of Western India. Some pure-bred animals: though not of the highest rank, still survive in some provinces of the Deccan, Central India, and Northern India, and in fact a number of provinces in India have no pure-bred cattle at all. Some of the causes of this deterioration of our stock are that the best animals are being exported to other countries and to many parts of India where they lose their vitality and the ability to keep up their yield ; moreover, thousands of our good pure bred cattle go to our cities and towns where they end sadly by going to the butcher. But the chief reason for the deterioration of our stock is most probably due to the fact that very little selection for breeding purposes is made. Generally the cattle—good, bad, maimed, and diseased—are allowed to breed and multiply. During the day cattle are herded in the grazing ground where cows are very often served by maimed, diseased or useless animals whose progeny become still more worthless. In this manner the quality has been deteriorating from year to year and from generation to generation. Another common system of breeding prevalent in the country is to allow a number of bulls usually called the Brahmani Bulls to roam about and to serve the cows. These bulls are not owned by any particular individual, but by the community at large. They are let loose, and it is a common and every-day sight in the bazars of our cities and towns to see these bulls going from shop to shop and from house to house for their daily ration. Breeding thus takes place in a most indiscriminate way, and there is no purposive selection. The first principle of Biology is "Like begets like." If poor quality are mated, poor quality cattle results. Inferior animals should, therefore, be eliminated from breeding. Superior bulls should be selected for breeding as they tend to transmit their good qualities in their offspring. The sire plays a more important part in breeding than the dam. The statement is often made that the sire is half the herd. But in practice it is easily seen that the sire is far more than that. "He is one-half the herd the first generation, three-quarters the second, seven-eighths the third, and fifteen-sixteenths the fourth." So powerful is the influence of the bull on a herd that if careful selection be maintained in breeding the cows of the herd for a generation he will mould the character of the entire herd. This fact should warn us of the necessity of exercising extreme care in the selection of the sire. Our cattle can only be improved if proper selection is made and strenuous effort made by the farmers, in general, to select the sire and the dam and to breed only from the best.

One pertinent question in this connection is what our aim should be in selecting any particular type or types for breeding. In an extensive country where agriculture and dairying must

necessarily be joint industries, and not divorced from each other, it seems, on the whole, more desirable to breed a double purpose than a single purpose animal. *Unfortunately the maximum draught and milking capacities do not go together*, and an ordinary rural farmer in India would, no doubt, be put in a dilemma if he were to choose between them inasmuch as both qualities are of equal need and value to him. So it seems desirable to make a compromise and aim at a harmonious development of both qualities than to strive after attaining the maximum in one direction alone. In cities and suburban areas where dairy farms are maintained as such, and not as an adjunct to agricultural farms, the aim should, no doubt, be to develop the milking capacity to the utmost, and at the expense of other qualities where necessary.

The problem of the provision of good breeding stock cannot be solved by the individual farmer, and this is due to the fact that the improvement of economic characters is a slow process, requiring years of careful study, patient effort, and money. When selection and improvement are restricted to a single definite character advances may be fairly rapid at first, but as maximum efficiency is approached the rate of increase rapidly diminishes, and improvement of the breeder. *The Department of Agriculture, therefore, should establish cattle farms, at least one in each district.*

In addition to the supply of breeding bulls the Department of Agriculture will have to endeavour to induce the rural cattle owners to use them for covering their cows by means of publicity, propaganda, and demonstration. Those living in the neighbourhood of the cattle farms should be conducted around at intervals to show them the good results already obtained and everything possible should be done to encourage them to come to the farms and to see the developments for themselves. They should be induced to bring their cows for being covered and no fee should be charged at first for the services of the bulls. For the benefits of the cattle-owners living away from the farms the District Boards should obtain bulls from the farms and maintain them at different centres. The Co-operative Department should encourage the formation of co-operative cattle-breeding societies, which would obtain bulls from the Government farms and maintain them for the use of the members and the non-members, the latter paying a small fee. If the larger land-owners and the more prosperous farmers can be induced to join such societies good results will spread rapidly. The bulls maintained by the societies must be properly cared for and fed.

Secondly, we come to the problem of the feeding. The farmers in India do not feel the necessity for providing sufficient pasture lands and leave their cattle to die for want of food. The

Use Cheddar Cheese Once a Day

cattle are left to browse on the roadsides or are tied near their house only to gaze at the fields of paddy and wheat around them. The consequence is that the cattle are only skin and bones, and so weak and stunted that they are unable to do much work. *It is an admitted fact that even pedigree stock will not produce good results if they are half-starved.*

During the day cattle of all ages, including the diseased cattle, are let loose together. All saunter off somewhere outside the village until evening when they make their way home. In the rainy season and some months afterwards grass grows rapidly on the pastures and there is plenty of food, but later on during the hot weather the condition is worse. This bad treatment is the chief cause of the present bad condition of our cattle and the scarcity of milk and pure *ghee* in the country.

As regards the shortage of fodder it has been suggested that the cultivators, zamindars, etc., should be compelled by legislation to set apart a portion of their land for pasture. It will be, however, impracticable to work any such legislation effectively because it pays the starving farmers better to grow any grain or fibre crop than to set aside a portion of their "few acres" for the growing of fodder crops. The cultivators then should be induced to grow fodder crops, but they will not do so unless they are convinced that fodder crops pay better than a grain or a fibre crop. The practical solution of the problem appears to be that far more attention should be paid than has been done hitherto to the growing of fodder crops. The Department of Agriculture should find out the kinds of such crops that will be most suitable in different localities. Finally the supply of fodder should be better distributed during the year by the construction of silos or receptacles for storing silage. Silage or ensilage, as it is often called, is green fodder which is preserved in a succulent and palatable form from the time when it is not scarce, so as to be available for use during the dry and hot season when green fodder of any kind is scarce. In the silo the modern agriculturist has devised a means of utilising green crops grown especially during the rains throughout the year. The silo not only enables the farmer to preserve green crops, but it impregnates it with new flavours, which enhance its value in some respects and makes a food easily relished by cattle. Juar, maize, alfalfa, cowpea, beans and grasses, when preserved in the silo, lose very little of their original succulence and palatability and there is practically no loss in weight. A silo must be air-tight and damp-proof. It is true that cattle do not like silage at first, on account of its peculiar sweetish smell, but if small quantities of it are mixed with straw or green grass, the animals get used to it in a few days, and afterwards they eat it with relish even when the quantity is increased.

Let us, thirdly, consider the problem of weeding. It is an admitted fact that India has a vast population of cattle as compared with other countries. "India with an area of 1,766,000 sq. miles has 174,757,422 bovine cattle, 2,114,400 horses, and 2,449,417 mules and donkeys and camels, making a total of 179,321 239, which is equal to 109·5 per sq. mile. The United States of America, with an area of 2,970,128 sq. miles, possesses 67,866,000 bovine cattle, 21,534,000 horses and 3,404,000 mules, a total of 92,804,000 equivalent to 31·2 to the sq. mile." From these figures it is quite evident that India, with little more than half the area, has almost double the number of animals used for draught and for milk production. *But it is an amazing fact that, in spite of a huge population of cattle in India, the demand for milk and dairy products in Indian cities and villages cannot be met adequately.* The reason for this state of affairs is that a vast number of cattle of the useless type are being maintained in the country. If they are eliminated the remaining cattle will have sufficient food to live on properly, and there will be no development of a number of worthless, diseased and maimed cattle every year. Unfortunately the worthless unpaying cattle are kept on owing to the religious susceptibilies of the people. Though the people as a whole consider the cow sacred yet there is no other country where she is so badly treated as in India. The starving animals on the roadsides and in the Indian bazars are a pitiable sight and bear testimony to the fact. So when we speak of cattle improvement we first speak of proper weeding. All worthless, diseased, and maimed cattle of the country which do not pay for their upkeep, and on the other hand hinder the improvement of our cattle, directly or indirectly, either by producing and swelling the numbers of worthless cattle every year or by feeding on feeds than can be better utilised by good animals should be totally annihilated without giving way to religious superstitions and susceptibilities. But it must be remembered at the same time that the total annihilation of cattle by the farmers in a single day or in a single year is not practicable. In this, as in all other directions, education holds the key of progress. When through proper education people come to realise that the existing cattle are too many in numbers, and of too low quality, they will themselves prevent such cattle from breeding. In this way the useless animals will be eliminated in the course of a short period. Deliberate destruction of animals simply for the purpose of weeding is out of the question.

A few lines about cow-slaughter in this connection will not be out of place when there is much confusion even among enlightened people in India regarding this particular problem. For the solution of cattle problem it has been often suggested that

the slaughter of the cattle for food should be prohibited on the ground that slaughter accentuates the present shortage of cattle for milk and draught. It has already been shown that India has a huge population of cattle, and hence the question of number can in no way be raised here. But it must be remembered that the stoppage of the slaughter of cattle far from helping the solution of the problem of cattle improvement will discourage the growth of the cattle-breeding industry by reducing the demand and the m rket for its products. It is a common-place of economics that the development of an industry is promoted most by securing the widest and best market for its products, and the industry in question is no exception to this rule. The supply of a commodity cannot improve either in quantity or quality if the market for it is restricted, and in this respect cattle are exactly in the same position as other commodities produced to satisfy human wants.

To sum up then the cattle of India can be improved only by proper breeding, adequate feeding, and judicious weeding of our cattle. Intelligent selection for breeding purposes, adequate feeding, careful management, and attention to cleanliness are the factors which make for successful cow-keeping, and, if greater attention and care were devoted to this industry in India, it would have a far-reaching effect not only on the health and wealth of the individual, not only on the health and wealth of the community, but on the health and wealth of the whole nation.

The Bore-hole Latrine—Village Cleanliness and Health—Again Dr. Spencer Hatch gives us the benefit of his experience with many practical suggestions. This article will appear in the April Number of the *Allahabad Farmer*.

A popular Note on the "Mineral Requirements of Cattle, Poultry"—This article will appear in our July Number.

PRACTICAL HINTS
ON
VEGETABLE CULTURE IN INDIA

By "Sherrard."

Introduction.—This unassuming little work has been undertaken primarily to assist the amateur with his "Cabbage patch" of half an acre, who grows a few vegetables for home consumption, as well as the land-owner who has a large area at his disposal on which he cultivates vegetables as a source of revenue. But the more advanced student will lose nothing by a perusal of these pages along with his scientific studies; indeed, he may profit thereby.

The very fact that you are reading this subject shows that you are interested in Vegetable Culture. The first thing to remember is that before you can reap you must sow and before you can sow you must prepare. It is regrettable that most cultivators, whether they grow vegetables for the home or the market, have no preconceived scheme whereby they undertake the preparation of the land for vegetable cultivation. By way of a beginning they prepare a small corner somewhere on their estate, but with complete disregard to future expansion. The ultimate result is a pronounced lack of uniformity in the size of beds and a meaningless net-work of roads, paths, and water channels. As one season succeeds another alterations and modifications are improvised, but instead of improvement further complications are involved.

In all business concerns proper methodical arrangements, though they entail a little trouble in the beginning, save maintenance and labour charges in the long run out of all comparison to the initial cost. Therefore before any attempt is made to commence work on the site it should be measured and the scheme carefully planned to scale on paper. There will then be no difficulty in working any one section of the land, extending and progressing according to plan. *Vegetable culture to be successful must be regarded as a purely business enterprise.*

If you were to invest capital in a business concern you would not do so without making yourself familiar with its workings. Most of the books written on this subject in India not only give a smattering of advice, but fail to take into account the mistakes and errors in cultivation that so often bring failure and disappointment. Pope once said: "A little learning is a dangerous thing." He did not say "A little knowledge is a dangerous thing" as is frequently misquoted. The smallest amount of knowledge is worth having. It is for these reasons I have dealt more fully with essential subjects, without being prolix, and at the same time I have avoided technicalities as far as possible.

One subject is dependent on another and the arrangement I have adopted is to provide a complete but concise course of instruction on Vegetable Culture. These instructions are written for the Plains of India, North of the Deccan as I am not familiar with conditions further south, but in principal and in general the instructions are not restricted to any particular area, indeed they are applicable anywhere, and the prudent cultivator should find no difficulty in making modifications to suit his own particular needs and the season.

The cultivation of vegetables is an art which claims the labours of both the Agriculturist and the Horticulturist. The methods they use vary but little, but their aim and achievements vary as night from day.

Strictly speaking, the Agriculturist grows his vegetables for animal consumption, whereas the Horticulturist caters for man. This does not mean that the Agriculturist must not grow vegetables for human consumption; if he does, he only alters his method to suit the end in view.

For animal consumption the Agriculturist's aim is size and bulk. For human cousumption the Horticulturist's aim is quality. The sooner this is understood the sooner will our markets be filled with vegetables more palatable than the usual coarse commodities exhibited for sale on the market.

It was not so many years ago that I judged at a Flower show which had been an annual event for ten or fifteen years. A group of Agricultural students followed me round showing keen interest in the judging. When I came to the vegetable stall their eagerness knew no bounds. I wondered at this at the time, but made no comment. I first surprised the spectators by calling for a knife. "A knife, no judge had used a knife before!" The knife caused some execution among the coarse cabbages (most of them being nearly as large as an elephant's head) woody carrots, and pithy turnips of colossal size which could barely be made to fit into an ordinary marketing basket ! Consternation among the students was rife when my choice fell on something which I would have relished on the dining-table instead of an article for my pet cow. These colossal, over developed products were those grown by the students themselves, a fact I only found out later.

For years this section had been judged from an Agriculturist's point of view. I do not know if I am right, but I think a Flower show is a Horticulturist's show and exhibits should be judged from a Horticulturist's standpoint, unless there is a separate section for Agricultural products.

However, my decision appears to have had the desired effect, and vegetables fit for human consumption are now presented for

exhibition by these same students. The competitions being keenly contested, the laurels being equally divided between the Horticulturists and the Agriculturists.

I am here concerned with the cultivation of Culinary Vegetables only.

The value of vegetables as a source of supply of mineral salts, vitamins, and cellulose for our body development is being constantly emphasised. Vegetables freshly cut and cooked immediately retain all these health-giving properties. Stale, coarse, overdeveloped vegetables have little or no nutritive value and impair the digestion. It is for these reasons, if for no others, that we should grow our own vegetables, or at least those varieties which are green in colour, such as Spinach, Cabbages, Peas, etc., and those which are eaten uncooked, such as Radish, Leek, Tomato, Lettuce, etc.

The Location.—The position for the vegetable garden should be free of trees, open, and the land well-drained. Low ground easily water-logged, though unsuitable to most vegetation, is particularly unsuitable to vegetable culture.

The site should be carefully planned with a view to affording the maximum facilities for operation; the most important considerations being the courses of the water channels for irrigation, and means of easy access to all parts by the provision of suitable "feeder" roads or paths. At the same time neatness and order and the exercise of taste in arrangement will denote the careful cultivator.

The plan of the garden will be governed by its size. The plan shown herewith depicts a suitable arrangement for a garden of about an acre. The main or "feeder" paths are 6 feet wide suitable to hand-cart traffic. The source of water is a well situated outside the area. Where the well is situated within the area modification of the plan will present no great difficulty.

For a garden less than half an-acre the main paths need only be 4 feet wide as a hand-cart will not be required inside the garden. Manure and other necessities can be easily carried to the work in hand. An area larger than two acres should afford main roads suitable to horse or bullock-cart traffic.

The main paths should afford easy access all round the boundary and also down the centre each way. Extensive gardens in addition to these paths should provide others which will divide the ground into suitable plots, so placed that a cart can approach to within 60 feet of any part of a plot.

These plots are then sub-divided into smaller plots by "economic" paths 2 feet wide. All roads should be straight and diversions at right angles to those roads.

Use Cheddar Cheese once a Day.

A hedge bordering the outer precincts, though not a necessity, adds greatly to the beauty of the site and affords suitable protection.

The vegetable garden is, as a rule, placed "on the edge of beyond," hidden away in the background as if it were something to be ashamed of. It certainly should not appear in the immediate foreground of a decorative garden, but there is no reason why it should not feature in the general scheme. It demands a secluded spot, not because it must be hidden from view, but because of the protection it requires.

My thoughts go back to a private garden I once knew of which I have many happy recollections. I saw it develop step by step from a barren waste to the conception of its owner. Open lawns predominated on all sides of the house bordered by an irregular, undulating hedge which conformed with the lay of the land and the permanent features on it; cunningly placed openings in this hedge lured the visitor to investigate. Hidden from view through one of these inviting openings you entered the rose Garden, which lay in peaceful seclusion bordered by a hedge. Curiosity led you to investigate another opening which brought you into the annual Flower Garden, a blaze of colour also in perfect seclusion. Another opening in the distance took you into the Fruit Garden with its tempting, luscious fruits well protected on all sides by a strong hedge. Yet another opening led you into the Vegetable Garden, with its majestic heads of cauliflowers, clusters of peas dangling in their hundreds, beets showing thin, bright red foliage in pleasing contrast to the feathery, green leaves of the carrots.

The proud owner told me that any visitor who had once seen his garden never neglected a visit to the vegetable plot in preference to any other section. In fact, the general tendency was "Let's see what you have in the way of vegetables." The most interesting discussions took place here, and you never left it without "Here take this home for your dinner to-night."

The vegetable garden can be made as attractive in appearance as the flower garden. It cannot impart the same splash of colour, but its straight path, straight rows of plants, and its well-filled beds present, not only a sense of majestic beauty, but a sense of importance as well and inspire thoughts of human accomplishment which no gaudy splash of colour can achieve.

If the centre of the vegetable garden is to provide the manure dump, if untidy scattered nursery beds are to feature along the paths stuck in here and there in full view, if literally the rubbish dump is to find a permanent home here, then you have every reason to be ashamed of your effort. No manure should be brought into the grounds other than that which is for immediate use. The

nursery plot should have a corner to itself, and all weeds, unwanted cabbage leaves, extra stakes, etc., should never be allowed to find a permanent home inside the grounds.

The Soil.—The soil performs but two functions. It fixes the plant in the ground, and it retains the water supplied for irrigation. It also acts as the medium which holds the necessary elements, which, when dissolved in water, go to sustain the plant, much in the same way as the water in a bottle of fever-mixture is the medium which holds the curative drugs.

Soils vary in "texture" between two extremes according to the predominance of clay and sand. A soil that contains an equal quality of both is the happy medium best suited for vegetable culture.

Soils of any nature (*i.e.*, texture) are either rich or poor according to the abundance of plant food they contain. A very sandy soil may look poor yet be abundantly rich in mineral salts suitable to plant growth. Such soils, however, no matter how rich, are of little use for vegetable culture because they cannot retain moisture, without which the plant cannot make use of the natural elements.

A soil of good texture, liberally supplied with humus (which is surface soil richly mixed with the organic matter derived from previous vegetation that has decayed on the land) is loam. This is the perfect medium for vegetable culture. Old pasture land, the surface soil from under old forest trees or bushes are rich in humus, and the soils from these places are naturally rich, loamy soils.

Almost every writer will state "the best soil is loam" and advises the cultivation of vegetables on loamy soils. Unfortunately we are not all happily placed in a position to choose. *Any soil can be made suitable.* Obviously the most unsuitable soils will require the most expense to bring them into condition. Fortunately, however, extremely suitable soils are rarely met with around habitation.

From the above you will have seen that the soil must fulful certain qualities. The soil must—

1. Be firm—to fix the plant. This condition must not be exaggerated. A hard, clayey soil packs hard, cracks up after each watering and is difficult to work. It also excludes air from the roots which is very necessary.
2. Be retentive of moisture to enable the plant to absorb the dissolved mineral and other salts through the roots. A soil predominating in sand allows the water to escape readily.
3. Contain the necessary elements—to provide for plant development.

The provision of these qualities are all within human reach. If the defects are not too serious, *i.e.*, if the soil is not too clayey, or too sandy, and, if not too deficient in humus, there is not much to worry about. All these conditions are improved by the yearly introduction of manure to the crops and by cultivating the soil, and, as the years go by, so the nature of the soil will improve through these agencies. A clayey soil is thus soon converted from a hard, tenacious nature to a mellow, friable condition. A sandy soil is made more solid by the unsoluble matter in the manure which is administered, whereas the soluble substances in the manure provide for the deficiencies in the necessary elements.

Where these defects are of a serious nature other means will have to be employed. Where the soil is hard and clayey, like black-cotton soil, an application of sand, if available in the vicinity, is the best medium to use to improve it. The addition of sand will only improve the "texture," not the "quality." The "quality" or richness is improved by the addition of manure which will be dealt with later.

The soil should be ploughed or dug to a depth of one foot before the monsoon. Over this surface spread a layer of sand. The amount required will vary according to the stiffness of the soil. A depth of six inches will be required for very stiff soils. When the monsoon is well-established the land should be ploughed three or four times so as to mix the soil and sand together.

A dressing of lime in the proportion of one seer to the square yard, or 100 maunds to the acre, will greatly improve the texture of a clayey soil. Old mortar, rubble, ashes (not cinders from mineral coal), bazar and kitchen refuse, etc., spread over the land and ploughed in will all help to improve it.

A very sandy soil, on the other hand, requires the addition of a stiff soil to make it more retentive of moisture. The same method of application is used. Digging pits or the disfigurement of the land for this purpose should be avoided. A layer of six inches or so scraped off from the surface of a large area, preferably high ground, will not blemish the appearance of the land. The widening of existing water channels will provide the necessary earth with advantages to both.

Poor soils, *i.e.*, those devoid of humus, require the addition of this organic substance to improve them. This is supplied in the form of organic manure and worked into the soil in the same manner as sand or loam is worked into unsuitable soils.

If the vegetable garden is within easy distance from a bazaar or large village arrangements should be made with the municipality or other authority to procure the daily garbage and sweepings.

For a clayey, sandy or poor soil there is no material which will benefit the soil more fully, and at such negligible cost. Where this is available other materials that have been recommended for the purpose should give way to this. The season and method of application will be the same as described for other materials.

(*To be continued.*)

EXPLANATION TO PLAN

THE PLAN IS NOT DRAWN TO SCALE

1. / / / / / / Hedge.

2. ═══ Feed paths 6 feet wide, so placed that a cart can approach within 40 feet of any part of a plot.

3. : : : : : : : Main water channels which should be made *pakka* if possible.

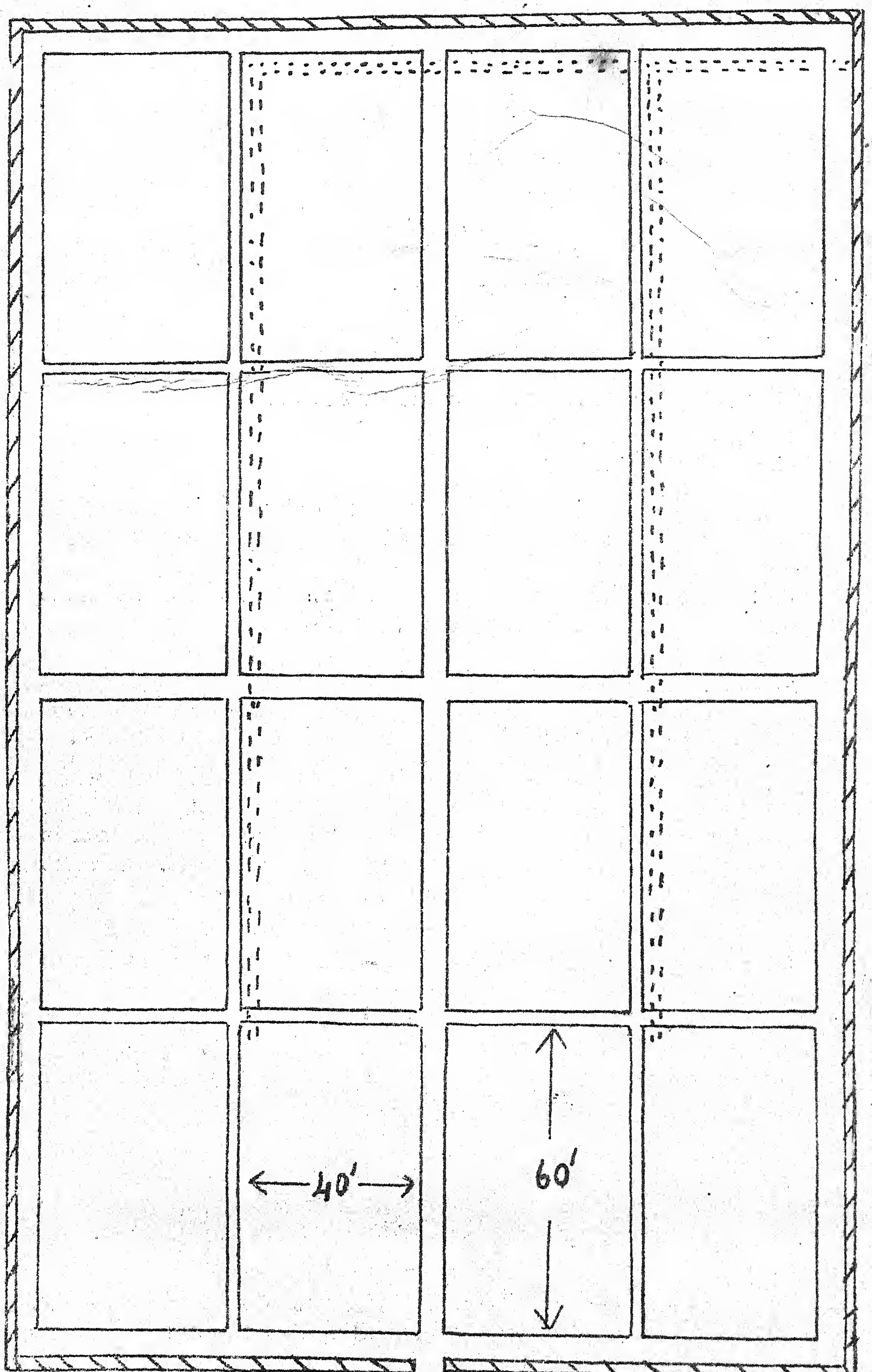
4. ═══ Economic paths 2 feet wide. Any of the beds can be sub-divided by temporary paths a foot wide to provide a smaller area for any given crop.

The beds are approximately 60 feet long and 40 feet wide. By doing away with the economic paths the beds become 120 feet long and 80 feet wide. These dimensions should meet the demands of extensive field cropping. In this case the *pakka* water channels should follow the course of the main paths.

Complimentary List Suspended.—We regret that owing to finances we are unable to continue our complimentary list. The list has not been very large, but every little bit of support helps, and we trust that those who have been receiving our complimentary copies will respond with their support and send in their subscriptions to the Managing Editor.

Eradication Dube-grass with the Wah-wah Plough Sweep—Another practical article right from the fields of experience to you. If your problem is dube grass then here is the solution.

The Importance of Balanced Rations for Poultry.—Mr. Jusawall in the April Number will contribute another article to his series on Poultry-raising.



Plan of a Vegetable Garden.

The Allahabad Farmer

"A two monthly agricultural journal undenominational in scope and interests and devoted to the dissemination of useful information calculated to promote a better understanding of agricultural practice and improvement in rural living."

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Contributions

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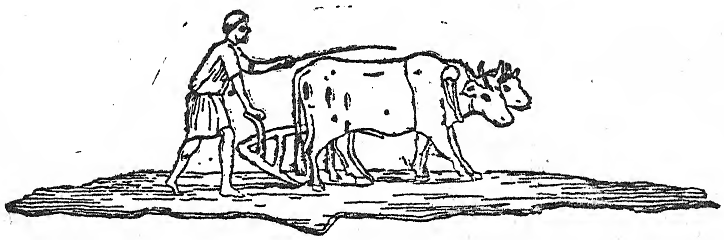

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ALLAHABAD FARMER

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EDITORIAL

The Ghee Trade.

We make no apology for reprinting the article on "The Ghee Trade of Etawah," by P. M. Kharegat, published in July, 1929, in the *U. P. Co-operative Journal.*

The manufacture of ghee is a large subsidiary occupation of cultivators in most provinces and of long-established practice. Since 1929, when the article referred to was written, we are glad to note that the U. P. Co-operative Department has made considerable strides in placing the dairy industry, as related to the manufacture of ghee, on an organized basis. No little credit is due to Mr. A. N. Sanyal, Co-operative Inspector, for his efforts in this direction.

The first Co-operative Ghee Society in the Etawah district was organized in September, 1929. Up till September, 1932, 23 active ghee societies have been organized. These ghee societies contract for more than 500 maunds of ghee in the season, with about 700 members. Something like Rs. 5,000 to Rs. 6,000 increased return is secured for these members compared to what they would receive as non-members.

These 23 societies are under the supervision of one supervisor. This number of village societies represents the number which he is able to efficiently supervise. It is hoped and urged that the Co-operative Department will increase the number of supervisors on its staff, and speedily organize ghee societies in every district of the provinces. Such organization is an urgent necessity of the present largely unorganized dairy industry in these provinces.

* * * *

An Opportunity.

At the present time the Co-operative Ghee Societies are largely doing a wholesale business with the local Etawah merchants. Very little actual retail trade has been developed. While the ghee societies have increased bargaining power with the local Etawah merchants and secure better wholesale rates, they still have a fertile field awaiting development in the line of retail sale direct to consumers, and they need to extend and establish retail sales depots in suitable centres.

To those of our readers who are in need of ghee, and who wish to secure the pukka pure and unadulterated, in the sense of mixed or containing foreign added matter, the Etawah Ghee Co-operative Societies are ready to serve you.

* * * *

Looking Forward.

The hot season will soon be with us, to be followed by the monsoon rains, and to be again followed by that great enemy of agriculture, namely—"EROSION." Each year tons of the most fertile soil from our fields is being lost to return no more. How can we prevent it?

In our July and September numbers you will learn how an Agricultural Engineer looks at the problem, and how he suggests solving the problem. In the meantime, look over your fields, and see if you can calculate what "erosion" has been costing you, in the way of decreased fertility, and uncultivatable gullies.

* * * *

Vegetable Culture in India.

In this number our readers will find the second instalment on Vegetable Culture in India by "Sherrard." These are most certainly practical hints, and we hope that our readers will profit by them.

If you have some problems not covered or explained fully to your satisfaction in these articles, we are pleased to invite your enquiries. Don't be bashful!

* * * *

Importation of Dairy Products into India.

Our readers will be surprised to know that, in spite of an import duty of 20 per cent on dairy products, there are large quantities of dairy products being annually imported into India.

The following table gives the value of imports of dairy products into India during the years 1928 to 1931 (in rupees):—

Articles	1928	1929	1930	1931
Butter ...	2,78,941	3,76,895	4,59,225	4,89,944
Cheese ...	11,62,384	11,56,503	10,12,324	6,91,570
Milk food for infants and invalids ...	32,58,438	35,25,886	28,34,247	25,75,681
Ghee ...	33,808	47,205	58,175	1,28,936
Condensed milk and cream ...	86,85,989	88,74,987	85,37,769	60,55,519
Total Rs. ...	1,34,19,560	1,39,81,476	1,29,01 740	99,41,650

The above figures, we think, indicate the tremendous opportunity for the development of commercial dairying in India.

Change in Editorial Policy.

Our constant readers will notice some new features in connection with this number of the *Allahabad Farmer.* You will have noticed that our Journal is being published in March, instead of April. This is due to changing the journal from a quarterly to a bi-monthly from January 1st, 1932. In future, you will receive six numbers in a year, instead of four.

Along with the change from a quarterly to a bi-monthly journal, there is also a small increase in the subscription rate from Rs. 2 per annum to Rs. 3 per annum. There will be no increase in the subscription rate or other adjustment to those of our present subscribers who have paid up in advance. Those of our subscribers who recently accepted our offer of "a two-years' renewal for the price of one" are particularly fortunate.

Renewals will, however, be accepted up until May 1st, 1933, at the old rate of Rs. 2 per annum, after which date the rate will be Rs. 3. Renewals will take effect from the date of expiry of your present subscription. Renewals for more than 1 year in advance will not be accepted.

Save Re. 1 by sending in your renewal now!

* * * *

Introducing Our Associate Editor: Mr. Bransley M. Pugh.

Mr. Pugh is a B.Sc. graduate of Calcutta and also a B.Sc. graduate of the University of California, U.S.A. He hails from Assam. His specialities are soil physics, agronomy, and general farm management. He also dabbles in experimental work, and is engaged, when not otherwise busy on a study of controlling weeds by the use of chemicals. Mr. Pugh is also the Vice-Principal of the Allahabad Agricultural Institute, Allahabad.

* * * *

Introducing Our Business Manager : Mr. W. B. Hayes.

Mr. Hayes is the head of the Horticultural Department of the Allahabad Agricultural Institute, Allahabad, U.P. He is also the Acting Principal of the Institute and the Honorary Superintendent of the School and Home for the Blind at Naini, U.P. After ten years or so in India he has accumulated a considerable amount of experience in his line. You are to have the benefit of his experience in some of our future numbers.

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Do any of these back numbers interest you ?

The Etawah Ghee Trade.—Etawah ghee has a good reputation, and finds a ready sale in Calcutta and Rangoon, fetching from Rs. 2 to Rs. 5 per maund more than ghee from other places. About half the ghee supply of Etawah comes from the Gwalior State, while the rest is from the interior of the Etawah district. There are three big centres: Auriya, Jaswantnagar, and Etawah itself, the latter being the most important. About 30,000 to 40,000 maunds of ghee are received in Etawah every year.

Grades of Ghee.—The ghee is divided into three grades or classes—

(1) *Pachar*—which is the best, and is produced from the milk of buffaloes which are not given any green fodder, but are fed at home on cotton-seed, etc. It has a good flavour, and is much appreciated in Calcutta, where raw ghee is used with rice. It cannot, however, stand being heated over the fire, and is therefore unsuitable for cooking, preparation of puris, etc.;

(2) *Thari-patti*—is second-class ghee, which is manufactured chiefly in the grazing area between the Jamuna and the Chambal. It is sweetish in taste, and forms good crystals. It is not as good as Pachar in flavour, though it is able to stand the heat better; and

(3) *Par-ghee*—comes chiefly from across the Chambal (Gwalior State). It is yellowish in colour, has no good crystals, and is slightly sour in taste. It has a heavy body, can stand heat over the fire very well, and is therefore particularly suitable for making puris and for cooking.

Mixing Ghee.—In order that ghee may make a wide appeal to all classes of purchasers, the wholesale merchants arrange for the judicious mixing of the different kinds of ghee that come into the market, in suitable proportions, so as to secure both flavour and aroma and body. This sort of adulteration, if it can be so called, is fairly common. In Bharthana, vegetable products are often mixed with ghee, but in Etawah the merchants have formed an association of their own, and have succeeded in stopping this practice by establishing a laboratory for the testing of the ghee and by boycotting those who are found to resort to adulteration with vegetable oils.

The Ghee Season.—The ghee season is from September to April. During this period a buffalo gives on an average 4 seers of milk a day, or 3 maunds a month. The milk is obtained, whether from buffaloes, cows, camels, etc., slightly heated, and then mixed with the previous days' curd in a pot, which is thereafter placed on a slow fire made from cow-dung cakes until the whole of the milk is converted by fermentation into curd. The curd is, every two or three days, churned by a wooden churner, or "rai." The buttermilk, or "chas," is used up by the family, while the butterfat, or "nainu," is collected in an earthenware pot for seven days, after which it is

melted over the fire and made into ghee. From each maund of milk from $1\frac{1}{2}$ to $2\frac{1}{2}$ seers of ghee are obtained. In a month therefore a cultivator gets from each buffalo about 6 seers of ghee and in the whole season he may expect to get from 1 to $1\frac{1}{2}$ maunds per buffalo.

How the Cultivator Disposes of His Ghee.—In order that his produce may be easily disposed of, the cultivator ordinarily enters into a contract with the local dealer, called a "Beyeopari" or a "Bania," in August for the supply to him of a fixed amount of ghee during the season, with a cash-down payment. The price thus paid in advance is usually from 25 to 30 per cent below the current market rate of Etawah, and is usually based on a maund of 50 seers. Thus, if the current price at the time offered by the merchants to the village dealers at Etawah is is Rs. 72 per maund, the cultivator who agrees to supply one maund during the season is paid Rs. 50 cash as soon as the agreement is made. If the cultivator agrees to supply the fixed quantity in a shorter time, he may be paid a little more, say Rs. 55. The cultivator also agrees to a penalty clause in case he fails to supply the stipulated amount of ghee. The usual custom is that the value of the deficient amount is calculated at the current rates, and 25 per cent added to that figure ; the sum so arrived at is deducted from the amount to be paid to him at the beginning of the next season. Thus, if a cultivator supplied only $\frac{3}{4}$ maund, instead of 1 maund, the price of the shortage, viz., $\frac{1}{4}$ maund is at Rs. 72 per maund, Rs. 18; to this 25 per cent is added, so that the figure becomes Rs. 22-8. At the beginning of the next season, if the contract is again for the supply of 1 maund, and presuming that the prices are stationary, the cultivator would not be advanced Rs. 50, as before, but only Rs. 50, less Rs. 22-8, namely, Rs. 27-8. If he is advanced Rs. 50, he would be expected to supply 1—45 maunds. Sometimes, with the reliable cultivators, the next year's contract is only for the supply of the deficient quantity of ghee, plus 25 per cent thereof; that is, Rs. 50, is advanced to the cultivator; but the cultivator has to supply, in addition to the maund of that year, 5/16 of a maund for the previous year, or 1-3 maunds in all.

It will be seen that by this system the cultivator is not concerned with the rise and fall in prices, and has nothing to worry about, except the supply of the fixed quantity within the stipulated time. But he actually pays a fairly highly rate of interest. Ordinarily, the dealer gets a return of 44 per cent on his investment, not counting the addition due to the fact that the money is actually realized by him not at the end of the year, but during the course of the next eight months or so. In case of default, to compensate himself for getting no interest in the previous year, he obtains 87 to 109 per cent in the following year. If more than $\frac{1}{4}$th of the total

amount of ghee contracted for remains unsupplied, the rate may be still higher.

Dishonest Practices.—Nor is this all! In addition to the squeeze enumerated in the preceding paragraph, he goes around to the house of each cultivator once a week and collects as much ghee as he can get. He carries his own weights with him. He is entitled to take 1 chatak extra for every 5 seers of ghee for wastage. He usually goes around when the men are away and only the women are present in the house, and he can therefore adjust his weights pretty much as he pleases. He may also make deductions for so-called bad quality. It is true he maintains a record of the amount of ghee received on each occasion from each cultivator, but he gives no receipt, and there is nothing to prevent him from manipulating the accounts. He alone is in a position to decide whether he has received the stipulated quantity of ghee during the season or not, and he usually takes good care to show that he has not received the full quantity, so that the cultivator may be compelled to deal with him again the next year, and not go to another dealer.

Owing to the growth of such dishonest practices on the part of village dealers, many of the better class of cultivators now prefer not to make such forward contracts, but to sell their ghee for cash whenever a dealer comes around for it. Even so, they may be cheated as to weights and as to the price.

On the other hand, the village dealer does render specific services to the cultivator. He often advances him money for the purchase of a buffalo, on condition that so much ghee is handed over in such and such a period. He relieves the cultivator of the trouble and worry of marketing his ghee or taking the risk of market fluctuations. He very often has to deal with dishonest cultivators and is badly let down by them. The dealer is also victimized by others when he goes to sell the ghee, that he has collected, in the market. Lastly, his working expenses are fairly high, and have to be met from the difference between the advance he gives and the market price at the time of sale.

How the Village Ghee Dealer Starts in Business.—In fact, the village dealer himself often starts his own business by borrowing a sum of from Rs. 300 to Rs. 500 from a commission agent at Etawah at an interest of 12 per cent on condition of selling his ghee through him. He provides himself with a pony, on which he loads two or four empty tins, with tin covers of the size of ordinary kerosene tins. He has to go around to each cultivator once a week and collect whatever ghee he can get. The ghee received from different cultivators is mixed up in the same tin and any dishonesty by one individual, if undetected at the time of collection, may result in spoiling the contents of the whole tin,

which holds about 18 seers of ghee. If the distance to the market is short, he takes the ghee there himself on his ponies or on camels from time to time. Otherwise each tin is loosely covered with mud, put in a piece of cloth and sent by bullock cart to the market. The cost of transportation comes to about 7 annas a tin, or one rupee per maund, for a distance of about 40 miles. On a pukka road the cost may go down to 4 annas a tin; while, if rivers have to be crossed, the cost may go up to 9 annas or 10 annas a tin.

The Ghee Market.—The village dealer takes his ghee to a commission agent, or "arhatia," who has a shop in the market. The latter is ordinarily the person who has advanced him money. The arhatias, who usually have dealings from Rs.2,000 to Rs.5,000, each have small godowns where the tins are kept. The "dalals" who are to be found in the market are then informed, and they, in turn, inform the local merchants of the arrival of the ghee. The latter then inspect it and try to settle its price. This is done by secret signs underneath a piece of cloth between the arhatia, on behalf of the village dealer, and the merchant or his dalal. The price settled is usually based on that ruling at the time in Calcutta; but, whereas the price in Calcutta is that for a maund of 40 seers, more or less, the same price is offered in Etawah for a maund of 50 seers. The rate having been settled, the "khonchis" take small samples from each tin to a laboratory maintained by the merchants' association for testing as to whether it has been adulterated with vegetable matter or animal fat. It is first tested by the Butyro refractometer; and, if it comes up to the standard, it is passed. This process only takes a few minutes. If it appears to be suspicious, it is subjected to a saponification test, which lasts for three or four hours, for ascertaining the percentage of fats and of butyric acid.

Further Testing of the Ghee.—After the ghee has passed this test the merchant has it taken to his own godown where a small weighed quantity of unboiled ghee is taken, boiled, and weighed again by the khonchi, aided by an assistant called the "takaiya." The percentage of moisture, or "matha," is determined in this way. Thereafter the whole of the ghee is weighed, and the net weight worked out by making due allowance for moisture. Thus, if the percentage of moisture is 5, and the gross weight of the ghee 1 maund, its net weight is taken to be 19/20 maund. This practice has to be resorted to because cultivators and traders often mix whey or water with the ghee. An admixture to the extent of seer per maund is allowable; but, if it exceeds this percentage, the merchant may even reduce the price rate fixed. This, however, is not usual, and the merchant hands over the cash payable by him for the net weight of the ghee, as arrived at by his khonchi after the boiling, to the arhatia, who, after deducting the various charges, pays the balance to the village trader.

Market Dues That Have to be Paid by the Trader.—The various market dues which have to be paid by the village trader are as follows:—

(1) 8 annas per maund for the commission agent;
(2) ½ ,, ,, ,, ,, dalali;
(3) ½ ,, ,, ,, ,, charity;
(4) ½ ,, ,, ,, ,, the ghee association;
(5) ½ ,, ,, ,, ,, godown charges, paid only by new traders;
(6) 1 pao of ghee per maund to the weighmen, which works out at 4 annas to 8 annas a maund. They often actually take 2 to 3 paos; and
(7) 1 pao of ghee per maund to the purchaser (merchant) for dirt, etc.

The merchant, in turn, has also to pay the following charges:—

(1) ½ anna per maund for the dalali;
(2) ½ ,, ,, ,, ,, charity;
(3) ½ ,, ,, ,, ,, the ghee association; and
(4) 1 pao of ghee per maund for "takaiya," *i.e.*, those who heat the ghee over the fire and mix it.

Ghee Mixing and Disposal.—The merchant, having paid the price of the ghee, arranges for the suitable mixing in various proportions of the different kinds of ghee purchased by him and stores the same in his godown in tins, which are then carefully soldered. These tins are the same size as kerosene tins. He then arranges with other merchants, through the trade association for the obtaining of a whole railway waggon for despatching the ghee to wholesalers in Calcutta. The price between the Etawah merchant and the Calcutta wholesaler is settled by correspondence on the basis of a maund of 40 seers, f.o.r. at Etawah station. The Etawah merchant has to bear the following expenses:—

(1) Cost of tins at 8 annas a tin, which comes to Re. 1-6 a maund;
(2) Export octroi at 5 annas a maund; and
(3) Cart hire to the station at 10 annas a maund, and loading charges at 2 pies a maund. The Calcutta wholesaler bears other incidental expenses, such as tips and expenses at Calcutta, which comes to 2 annas a maund, in addition to railway freight, which comes to Re. 1-1 a maund. The Etawah merchant is not an independant

individual, but only the local agent of the Calcutta wholesaler.

It has not been found possible to trace the further progress of the ghee till it finally reaches the consumer in or near Calcutta. Doubtless the system of distribution to retailers and sale to consumers is similar to that in all other trades.

What steps should be taken to organize the trade on a co-operative basis? The question in front of us now is, What steps should be taken to organize the trade on a co-operative basis. I shall be glad to receive practical suggestions on this point, and it is hoped that the inspector who made this enquiry will be able to make a beginning before long in making such arrangements for the collection of ghee on co-operative lines.

ERADICATING DOOB-GRASS WITH WAH WAH PLOUGH SWEEP

IRA HATCH.

A strip of fertile kachar at the Allahabad Agricultural Institute was so badly infected with doob grass that the wheat crop on this field a year ago was almost a total failure. This land was selected as a trial plot for seed-bed preparation with the Wah Wah plough. After the monsoon, and as soon as the soil was dry enough to work, the field was ploughed with a small mould-broad plough. This did not kill the grass, as there was ample moisture present to allow the roots and underground stems to set out and continue growth.

Further ploughing with a mould-board plough to destroy the grass would have meant the loss of moisture brought to the surface by inverting the soil. The necessity for preserving moisture at this time for the germination of seed is well known. The sweep provided as regular equipment with the Wah Wah plough was used. As this does not invert the soil, little moisture is brought to the surface, where it would be evaporated by sun and wind.

The action of the sweep was to cut off all roots at a depth of approximately five inches (5″). Following up with a spring-toothed harrow or five-toothed cultivator, easily brought cut-off roots and stems to the surface. This also shook off most of the adhering dirt and left them to be dried in the sun, where they were later raked up and removed from the field.

Similar sweeps, such as are in common use in America, were tried attached to the above-mentioned five-toothed cultivator. This was not successful where the grass was thickly matted as

clogging between the sweeps and posts occurred. The draft was also too great for small bullocks.

The Institute's smallest pair of animals was not overloaded by the Wah Wah sweep under average ploughing conditions. These animals are young and smaller than the usual run of village bullocks. A larger pair—not much, if any, larger than the average—was used where the sod was particularly tough.

These operations resulted in a well-prepared seed-bed; and we are confident that the very small amount of the grass that remains will be entirely eradicated by the end of the second year.

THE PRACTICABILITY OF DEVELOPING DAIRYING AS A VILLAGE INDUSTRY IN INDIA

No. 18 of the agenda of the Animal Husbandry Wing Meetings of the Imperial Council of Agricultural Research, New Delhi, February 20th-25th, 1933.

Paper presented by W. J. Hansen, Esq., Allahabad Agricultural Institute, Allahabad, U.P., India.

Introduction.—The term dairying covers a considerable field. It covers the use of a wide range of knowledge and of practical work. The dairy industry is defined by dividing it into two phases:

(*A*) *Dairy Production.*—(1) This phase of the dairy industry involves the knowledge and practice of the growing of fodders and concentrates required for cattle feeding, a knowledge of economical methods of cattle feeding, breeding, and general management and the sanitary production of milk.

(*B*) *Dairy Manufacture.*—(1) This phase of the dairy industry, only slighty developed in India, involves the processing of milk into various marketable products, such as milk, cream, separated milk, butter, butter-milk, butter-oil, casein, cheeses, condensed milk, evaporated milk, powdered milk, modified infant milks, ghee, koa, milk confectionery, dahi, acidophilous and bulgaricus milks, ice-cream, condensed butter-milk, and condensed separated milk.

(2) This phase (dairy manufacture) also involves the *organized marketing* of the above-mentioned dairy products, through wholesale and retail distribution, by means of separating stations, ghee collection and grading centres, milk collection and distribution centres, centralized dairy factories, wholesale and retail sale depots, and transporation and delivery systems.

Some Essentials for the Development and Expansion of the Dairy Industry.—Any organized effort to be made at developing

the dairy industry in India should aim at the development and expansion of these two major phases of the industry—production, manufacture and marketing—in a well-balanced manner.

A (1) *Some Requisites for the Development and Expansion of Dairy Production.*—(1) It is common knowledge that the production of milk in India is largely in the hands of the Ahir caste—the gwala. Not all Ahirs, however, follow the traditional occupation, and those who do follow the traditional occupation of tending to cows and buffaloes do not generally mix their occupation with that of cultivation. For increased milk production, it is very necessary that increased fodders and concentrates be grown for cattle feeding. In the interests of increased milk production, it is very important therefore that the milk producer—whether of the Ahir or other caste—increase his cultivation of cattle feeds.

(2) In the development of increased dairy production, a primary and continuous need is the weeding out of cattle of undesirable type and low milk-productive capacity, and the establishment of improved breeds of indigenous cattle, of good type and milk-producing ability. For this purpose, taqavi should be provided to the dairy producer to enable him to discard his inefficient stock and purchase replacements.

(3) In the field of dairy cattle breeding and milk production, there is a distinct opportunity for the large landowner to be of service to the country by the establishment of cattle-breeding farms along improved lines from which improved and pedigreed stock may be available to the tenantry and small village breeders. Such farms should complement the work of the Dairy Sections of the Agricultural Departments in the distribution of stud bulls of proven worth to every district. They should form the centre for co-operative bull associations; co-operating milk-recording societies. These "gentleman farmers" need to be encouraged to take up cattle breeding as a form of patriotism, a hobby, and a business. The establishment of such private cattle-breeding farms will do much to check the deterioration of cattle and preserve the identity of desirable indigenous breeds of cattle. Without this interest and the support of the more influential landowners and zamindars in cattle breeding, really effective improvement will be hampered.

(4) In the development of dairy production, the onus of the work will fall on the Agricultural and Co-operative Departments. In order that they may adequately cope with the problems, and assist in the weeding out and replacement of stock, etc., the staffs of these departments need to be materially strengthened, particularly the Dairy Sections of the Agricultural Departments, to enable the sections to extend their operations to every district in the provinces.

(5) *Summary of Some of the Practical Aids Whereby Dairy Milk Production May Be Increased.*

(*a*) The increased cultivation of fodders and concentrates for the feeding of cattle;

(*b*) Taqavi to the dairy producer to enable him to weed out his undesirable cattle and purchase replacements;

(*c*) The establishment of cattle-breeding farms by the more influential landowners and zamindars, coupled with the distribution of stud bulls of proved worth ; co-operative bull associations; and co-operative milk-recording societies; and

(*d*) The strengthening of the staffs of the Dairy Industry Sections of the various Departments of Agriculture and the Co-operative Departments, to enable them to extend their operations to every district of the provinces.

B (1) *Some Requisites for the Development of Dairy Manufacturing in Indian Villages.*—(1) The production of milk, and its processing and marketing, are separate operations. Both operations require a special knowledge, skill, and practice. The status of the dairy industry in India is interdependent upon the lines of development of these two phases of the industry—production and manufacture. Dairy manufacturing particularly is the job of an expert—of a man specially trained in this branch of dairy science. It will not be either practicable or profitable to train the milk producer—the Ahir generally—in methods of dairy factory manufacture. The practical opportunity lies in training promising young men in this line. These trained men can either work their own enterprise, or work as employees of a village co-operative society, or work in the employ of municipalties on inspection staffs. The primary need is for skilled, trained men in the dairy manufacture line.

(2) The development of dairy manufacturing is quite dependent upon the training and education of young men to take their place in the field of commercial dairying. To this end, a greater emphasis needs to be placed upon all branches of technical dairy education in all the agricultural colleges in India. The dairy equipment and facilities of existing agricultural colleges also need to be increased in order to cope with this need.

(3) Schemes for the development of village dairy enterprise will invariably require capital for dairy equipment and appliances. Such worthy schemes should be financed by private capital, supplied by landlords, and in the form of credit from central co-operative banks, together with small subsidies by provincial Governments.

(4) *Summary* of some of the practical aids whereby the village industry of dairy manufacturing may be established:

(*a*) The training of men to take up their own enterprise or to work as employees of a co-operative society or on municipal inspection staffs;

(*b*) Increased emphasis on dairy education in existing agricultural colleges by increasing equipment and facilities, *together with the popularizing of dairy education by the granting of scholarships to promising young men*;

(*c*) The financing of dairy schemes of development by private capital; by the landlords; by subsidy from provincial Governments and credit from central co-operative banks.

B (2) *Some requisites for the development of organized marketing of the dairy products of the village:* (1) One of the biggest obstacles to a well-organized system of marketing village dairy products is the general lack of strong municipal dairy legislation (ordinances) and regulations for the production and sale of dairy products, and the general lack of enforcement of those ordinances in existence. The village dairy industry requires the support of strong municipal legislation in order to protect honest individuals, producers, and consumers against unfair competition and adulteration. Dairy legislation under the Prevention of Adulteration Act is needed in each municipality, together with a strong staff, for its enforcement. Private or co-operative dairy enterprise cannot be expected to thrive in a situation where the bad drives out the good. All municipalities having milk ordinances should be encouraged to rigidly enforce them, and those municipalities that have not adopted regulations for the control of the production and sale of milk and other dairy products should be brought into line.

(2) Any new dairy scheme of development will be up against vested interests and the deep-rootod prejudices of the consumer. Consumers will have to be practically re-educated to the value of milk—nature's most nearly perfect food. Dairy educational propaganda aimed at increasing the consumption of milk can be carried on through the press, dairy exhibits at fair and melas, the cinema screen, and handbills. This type of propaganda work should be centralized with the Dairy Section of the Agricultural Departments and the Co-operative Departments.

(3) In order to strengthen the marketing of indigenous dairy products, additional support is needed in the way of tariffs, as a temporary measure, against the importation into India of such dairy products as butter, cheese, condensed milk, evaporated milk, powdered milk, casein, and casein products.

AGRICULTURAL

(4) *Summary* of some of the practical aids requisite for the development of the organized marketing of dairy preducts:

(*a*) Strong municipal legislation, and enforcement regarding the production and sale of milk and milk products;

(*b*) Centralized dairy educational propaganda through the press, dairy exhibits at melas, the cinema screen, and handbills in order to re-educate the consumer regarding the value of milk and milk products—nature's most nearly perfect food;

(*c*) Increased tariff protection, as a temporary measure, against the importation into India of butter, cheese, condensed milk, evoporated milk powdered milk, casein, and casein products.

General summary of the practical aids requisite to the organized development and expansion of the dairy industry—production, manufacture and marketing: (1) The increased cultivation of fodders and concentrates for the feeding of cattle.

(2) Taqavi to the dairy producer to enable him to weed out his undesirable cattle and purchase replacements.

(3) The establishment of private cattle-breeding farms by the more influential landowners and zamindars, coupled with the distribution of stud bulls of proved worth, co-operative bull associations, and co-operative milk-recording societies.

(4) The strengthening of the staffs of the Dairy Industry Sections of the various Departments of Agriculture and the Co-operative Departments to enable them to extend their operation, to every district of the provinces.

(5) The training of men to take up their own enterprise or to work as employees of a co-operative society or on municipal inspection staffs.

(6) Increased emphasis on dairy education in the existing agricultural colleges in India by increasing equipment and facilities, together with the popularizing of dairy education by the granting of scholarships to promising young men.

(7) The financing of dairy schemes of development by private capital; by the landlords; by subsidy from provincial Governments and credit from central co-operative banks.

(8) Strong municipal legislation, and enforcement regarding the production and sale of milk and milk products.

(9) Centralized dairy educational propaganda through the press, dairy exhibits at fairs and melas, the cinema screen, and handbills in order to re-educate the consumer regarding the value of milk and milk products—nature's most nearly perfect food.

(10) Increased tariff protection, as a temporary measure, against the importation into India of butter, cheese, condensed

milk, evaporated milk, powdered milk, casein, and casein products.

Conclusion: The status of dairying in India is in a well-nigh hopeless state. Strong measures are required in order to place the industry on an organized basis. It is an urgent need! A start has been made in many directions by the Agricultural and Co-operative Departments, but more attention and concerted action need to be given to dairy development. Agricultural colleges are also required to place greater emphasis on dairy education, and the popularizing of such dairy education is required. Landowners and zamindars should develop their own dairy cattle-breeding farms and lend their capital to private and co-operative enterprise.

All phases of the dairy industry—production, manufacture and marketing—must be equally stressed in order to have a well-balanced and organized development.

VILLAGE CLEANLINESS AND HEALTH

I.—THE BORE-HOLE LATRINE*

By Dr. D. Spencer Hatch

Improvement in cleanliness and health must become a part of every adequate programme for Rural Reconstruction.

The habit of defecating on the surface of the soil around human habitations in this country leads to a great amount of disease. Among the diseases caused and spread in this way are: hook-worm, which by careful test is found to have victimized some ninety per cent of the people in this state; typhoid fever, which claims a surprising number of people in the rural areas; and dysentery, which is another of the very bad epidemic diseases.

Lack of realization of the need of latrines is one of the reasons why this pernicious method of disposing of human excrement continues. This lack of realization extends not only to private families, but is the cause of there not being a single latrine for rural schools over whole areas. In some of these schools there are as many as two or three hundred boys and girls each.

An inspectress of schools in one part of South India asked the enthusiastic head master of a certain school what arrangement he had for latrines. The following converatiom ensued:—

"Oh, yes, we have a very excellent arrangement!"

"What is the arrangement?"

"Well; the boys use the front lane alongside the schools, and the girls use the back compound."

[*This latrine will be demonstrated at "The Farmer's Fair!"]

Even the principal of a women's college was accused of being a recent arrival, and of making trouble when she became concerned about a college girls' hostel having no latrine. The other reason for indifference about latrines is that the few existing ones are mostly such unpleasant affairs, seeming to many to be even more offensive than to spread the fæcal matter over the top of the ground. An improperly-built and improperly-cared-for latrine is certainly one of the most unpleasant things possible in this world.

Unsatisfactory Methods

In South India there are three common kinds of latrines in common use. In many houses a small pit is dug, and the contents are supposed to be emptied daily. Unless great care is exercised in cleaning it daily, it is a very unsatisfactory type. There is an obnoxious smell from the fæces during the whole day and night, and flies collect. Where there is a scavenger service some people use a small bucket, which is emptied once a day, but this is not possible in the villages. The third variety is a kind of pit latrine. Sometimes it is an open pit of some depth, with a wooden plank across it. It generally has a wide mouth because it is impossible to dig it otherwise. This kind breeds flies in great numbers, is accessible to birds and insects, and is offensive to smell and sight. A few rich people make their pits expensive and deep, and cover them with wooden or stone platforms. Besides being costly, these are generally offensive in smell. Decomposition goes on very slowly in such latrines.

Many of those who have no latrines at all have seen these other kinds, and certainly have no desire to have them. They say to us also that it seems almost like a silly idea that they need latrines when there is open space about. They know that in the nearest cities the gutters of the streets are used; they think they are much better off than the thousands of people who live near these gutters.

Dawning Consciousness

So at first there is little response to our teaching about latrines. One of the encouraging factors of our Rural Reconstruction experience, however, is the dawning consciousness of the filth that pollutes the ground in these villages, and of the need of sanitary methods. Then comes the desire to have latrines. I see, after a year or two, in the same villages where the latrine idea first seemed to the people absurd, leaders making impassioned and intelligent speeches about the filth of the village and the need of latrines; and I see some of these leaders start the campaign of better conditions by putting in proper latrines themselves.

The Bore-hole Latrine

From the far north of India and from the south I have letters asking about the bore-hole latrine, which, I believe, has been proved to be a most satisfactory one for many parts of India. I recommend these latrines after trial in the area where I work; and this experience of ours is backed up by the successful use of these latrines in Ceylon, the Philippine Islands, and Java, in some parts of the Madras Presidency, and in other places. The Madura District Board is said to have brought about the installation of some three thousand of these latrines since 1927. We have worked towards the propagation of these latrines in the villages of the Martandam area since 1929; and now the Travancore Department of Public Health, having selected the next taluq to ours to make a demonstration for the whole State of what can be done toward better health, has plans for the adoption of the bore-hole latrine in every house in the Neyyattinkara town and the adjoining pakuthis, and to extend this throughout the whole taluq.

The bore-hole latrine combines utility and sanitation, and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or schoolchildren and teachers will perform the labour themselves, as they very well can. Next week we shall tell how bore-hole latrines are constructed, and how they can be made available for all the rural people.

II.—HOW TO MAKE BORE-HOLE LATRINES

Borer Loaned to Villagers

The need of satisfactory cheap latrines was dealt with in our last article, and the following descriptions of how the bore-hole latrine can be constructed and made available for families and schools are given in answer to many questions.

The Borer

A round hole in the ground from 15 to 20 feet deep and 17 inches in diameter is made with the boring instrument. Various types of borers have been tried. The one which has been found most successful by the Rockefeller Foundation in its tests in many places. This borer holds the earth within its cutting blades after it has loosened it so that the earth may be lifted out of the hole by lifting the borer. These boring instruments are made in America and England. Generally, only

the boring bottoms are imported; and the extension rods, in sections, to be put on as the hole deepens in boring, are made in local workshops. A cross-bar or a long pipe wrench is used for turning the instrument in boring. The boring machine complete should not cost more than Rs. 100.

Carried from Village to Village

Our system of helping villages to have these latrines is that we own the borer, which is freely loaned to anyone who wishes it. After the dawn of consciousness of filth and need of latrines the borer is in great demand, has a waiting list of those who want it, and is carried back and forth from village to village.

Families and schools are encouraged to do the boring without hiring labour. This in itself is good training in the dignity of labour done for useful purposes. The Rural Reconstruction worker can take right hold of the borer, and set the example. Our students in Rural Reconstruction have no objection to doing this boring work.

If labour is hired. about four men are required, and it would take one or two day's boring, according to the softness or hardness of the soil. At the price of labour current in South India the labour may cost Rs. 2 to Rs 3. We have invented a wooden frame guide to steady the instrument. It is put on after the first three feet. It helps to wards a straighter hole, and saves one labourer.

The Stone Slab

When the hole is finished, a slab for the top, called a squatting slab is necessary. This may be made of reinforced concrete. I bought the first one from the Department of Public Health, Madras, for Rs. 3-8. It weighs 140 lb., and is an excellent slab. But this cost, Rs. 3-8, would defeat the project of having poor families adopt this latrine. Even live interest created would not influence the poor family to spend a third of a month's income on a top for the latrine. We had to make a cheaper one, and we have done so. The slabs we use are made from the granite of our local rocks, which are all about us, and each slab costs Re. 1. A representative of the Rockefeller Foundation says that these slabs are quite adequate, and that they are the most inexpensive successful ones that he has seen invented anywhere in the world. We make them in two half-sections which fit together. Thus they are easier and cheaper to make, and lighter to carry. When the stones are laid, a handful of cement should be used to close the joints, making them watertight.

Considerable encouraging needs to be done to ensure that the stone is placed in position as soon as the hole is bored. The soil at the sides of the stone should be heaped up even with the level of the stone and rounded off so that the surface water will run away from the hole, and not into it. A good size for the hole in this slab is 14 inches from front to back, 5 inches broad behind, and 4 inches in front. The hole may be cut in straight lines, or it may be rounded. Opinion is in favour of this smaller size hole, which is suitable to all members of the family, including children. The representative of the Rockefeller Foundation says that foot-rests are not necessary. They have some value towards causing the user to take a right position. If sloped fairly sharply toward the front, the user will be disinclined to turn the wrong way. The Travancore Health Unit in Neyyattinkara Taluq has invented a good reinforced-concrete slab which costs Rs. 3. This is made on a wooden mould which causes it to be dished towards the centre so that all liquid will run into the hole.

It is noticeable that, even when one of these latrines is used by many people, it is free from all offensive odours and is æsthetically attractive. The deep hole is dark inside, and insects do not enter. When the hole is filled up to near the top, the large blue-bottle fly may enter and breed there. This and the development of maggots may be prevented by an application of quicklime every ten days. Lime should always be used in latrines after they are filled up within eight feet of the surface.

Experiments indicate that it is safe to bore these latrines 25 feet from a well; but, to be very safe, we would not put them within 75 feet of a well. Do not be disturbed if water is struck near the bottom of the latrine. Water at the bottom of the latrine does no harm; and, if it is present, the action is similar to that of the well-known and scientifically sound septic-tank latrine. Sandy soil produces a difficulty. It may be overcome by the use of basket-work stays, pipes, or small barrels one on top of the other.

Sanitation with Utility

An ordinary family of up to seven persons will use one of those latrines 1½ to 2 years before it is filled up. If lime is used, the hole may be used to within 2 feet of the surface. Then the slab is removed and the hole is filled up with earth, which is slightly mounded above it. The place of the hole is marked by two stakes securely driven. Another hole is now bored near the first one and the slab is placed over it. After a year the night-soil in the first hole will have been completely deodorized and pulverized; and all germs will have been destroyed by the action of bacteria from the soil around the hole. Before the second hole is filled up the first hole is bored out with the same borer. This is very easy

boring, and will require little labour. The material will be found to be dark in colour, of convenient consistency to spread on the land, and an excellent fertilizer. Some of India's most far-seeing men have been looking for a sanitary system which would combine utility. The Japanese and Chinese are very diligent in using every bit of human night-soil as manure. Even churches have a means of income from having latrines at the back of their church buildings, from which the manure is sold.

Latrines Yield Profit

No country more than India needs manure to fertilize the soil. These bore-hole latrines can thus be an economic asset, and will yield valuable manure worth more than the cost of the latrines. The total cost of constructing the two holes may be something like Rs. 7, whereas they should yield four cart-loads of manure. This kind of manure is selling in certain rural areas at Rs. 5 per cart-load. Thus there is a possible profit of Rs. 13 in the first year from a latrine, and the profit will be greater in future years for the same holes are used, and expenses of construction do not recur.

When the second hole is filled up, it is closed in the way described, and the slab is put back over the first hole, which has now been emptied of its contents. So these two holes can be used indefinitely.

SOME PRACTICAL ASPECTS OF CATTLE BREEDING

By N. R. Joshi, I. D. D.

Dry Period Increases Cost.—In the management of dairy cattle no single factor is responsible to such an extent in increasing the cost of production of milk as the maintenance of the cattle when they are dry. The longer the dry period, the greater the cost of milk production. Taking two cows of equal production, the one with a shorter dry period is much more economical than the one with a longer dry period. Vigilant management always tries to cut down this dry period to a minimum compatible with efficiency; but for this the animals must have a high degree of fertility. Fertility is specially important in the case of dairy cattle for the absence of it does not only mean loss of progeny, but also loss of milk. In Western countries, where dairy cattle have been bred to a high standard of efficiency they are fairly regular breeders.

Lack of Fertility in Cattle.—The purport of the present article is to enumerate some of the causes leading to the absence of fertility. This absence of fertility in cattle is called sterility. Sterility may be either temporary or permanent. Sterility is

common in both males and females. The following are some of the causes of failure to breed:—

In Females.—(1) Dietetic errors: Overfeeding, as well as underfeeding, may result in follicular atrophy in females. In the former the ovarian metabolism is disturbed by the deposition of fat; the latter may induce cessation of œstrum as the lack of sufficient nourishment retards the ripening of the follicles; hence no ova are discharged. Unbalanced rations should be avoided to correct this.

Vitamins and Sterility.—Evans and his coworkers have shown that, besides the various nutrients required for the body, repoduction requires an additional substance now generally known as vitamin E. It was further shown by them that, though the ovary and ovulation are unimpaired in the females by the lack of this vitamin, a highly characteristic disturbance occurs in gestation.

Minerals and Sterility.—Insufficiency of minerals in feed upsets the proper functioning of the different organs, especially in dairy cattle, who pass out large quantities of minerals through their milk; a large intake is necessary to maintain the mineral balance in the body. Lack of this may induce reproductive disturbances, such as failure to conceive or failure to ovulate.

Anatomical Defects may lead to Sterility.—The peculiar formation of the hind quarters, inducing imperfect copulation and facilitating the ejection of semen, may result in failure to breed. Also occlusion of os uteri, displacement of womb and prolapsis hinder conception.

Diseased Reproductive Organs. Acidosis: Excessive acidity of the vaginal mucus retards the activity of spermatozoa, and thus results in failure to conceive. Cystic degeneration of ovaries: resuts in failure to come in heat. Squeezing of the ovaries is advocated to correct this.

Abnormal retention of Corpus Luteum in the ovaries results in the at cession of œstrum.

Retention of after-birth causing chronic inflamatinon of the uterus or vagina may lead to sterility.

Contagious abortion has been frequently attributed as the common cause of failure to breed.

Apart from the above causes leading to infertility, *inheritance* is one of the most important factors in determining the degree of fertility. There is a growing body of evidence on hand now to show that different degrees of productivity, down to sterility, may be inherited as though they were Mendelian units. This probably explains as to why inbreeding tends to diminish fertility.

Now we may turn our attention to the *causes leading to sterility in males.* Sterility in males may be either due to inability to copulate or inability to produce vital sperms. According to

Marshall, the *causes leading to the failure in copulating* are classified under four headings—anatomical, physiological, pathological, and psychological.

Anatomical causes include injuries and deformities of reproductive organs. Under the physiological and pathological causes are included incomplete erections and premature evacuations. Psychological causes may be either due to fear or lack of desire. Certain motor disturbances, such as painful affections of the joints, weakness in the hind quarters, etc., cause fear in the animal to jump over the females. Sexual or physical overwork, sudden change of environment, and unbalanced feed may lead to lack of desire for copulation. The mere fact that the male performs the act of copulation does not ensure his being fertile. It is possible he may not be producing fertile semen, and the result is failure to repoduce.

Savage classifies the *abnormalities of semen* under the following heads:—

(1) Absence, defects, and deformities of spermatozoa in the semen.

(*a*) In some cases sperms may be absent (azoospermia);
(*b*) In some cases the sperms may be imperfectly developed;
(*c*) Under defects and deformities, it may have a defect either in the head, the middle-piece, or the tail of the sperms.

All these conditions result in failure to fertilize the ovum.

(2) Admixtures of foreign elements in the semen. Various kinds of epithelial cells, pus cells, blood cells, etc., may distort the sperms.

Having enumerated some of the causes leading to sterility in males and females, we may give briefly some of the preventive, as well as curative, measures to be adopted: (1) Judicious feeding and care must be given to all of your breeding stock. Feeds too rich in carbohydrates and fats should be avoided. Overfeeding, as well as underfeeding is detrimental to breeding males and females; (2) Variety of feeds and green feeds should be supplied for the provision of nutrients, as well as vitamins from different sources. (3) A sufficient allowance of mixture is essential for the breeding stock; (4) Imperfect copulation, due to undersized bulls serving large females, with the result that they deposit the semen only in the vulva, may be prevented by allowing the bull on to a raised serving-ground higher than the females. Imperfect copulation is also due to using oversized males on small females; in this case, strain or pain of the service is so great that the cow does not retain any semen; the use of a breeding crate will relieve this trouble; (5) Making the cows run or walk a considerable distance just after the service facilitates the ejection of semen; hence it must be avoided;

(6) Cystic degeneration of the ovaries is sometimes corrected by the squeezing of the ovaries; (7) Nowadays the ovary-stimulating hormones are injected into animals for correcting the cessation of œstrum; (8) For those cows which show a very high degree of acid reaction from the vaginal discharge, douching with a solution of bicarbonate of soda would prove succesful; and (9) Cows which have either retained after-birth or aborted should be douched every day for a fortnight or so with a solution of either salt or potash permanganate.

In the males, too high condition or too poor condition may result in temporary impotency: (1) They should be thrifty, but never fat; (2) The bulls should always receive some exercise: lack of proper exercise may induce laziness, resulting in aversion to breed; (3) Accidents and injuries to reproductive organs should be promptly treated; (4) Sudden change of place and environment leads to temporary impotency, but this may be overcome by judicious feeding and care; (5) Sexual overwork is one of the frequent causes of aversion on the part of the bull to cover the cow; for this the services of a bull should be well regulated, and in no case should a bull be allowed to dissipate with the cows in heat. A mature, healthy bull should not be allowed more than 100 to 120 services in a year; and(6) A bull which looks healthy and performs the act of copulation satisfactorily, but does not "settle the cows," should receive the close attention of a veterinarian. The bull's semen should be examined microscopically. If the spermatozoa show defects, the bull should be castrated.

A recent development which may be of interest to dairymen in India has just been announced. The sterilizing of milk has been one of the ideals long sought, but not attained. Milk and milk products spoil because of the growth of micro-organisms in them. If they can be killed, milk can be kept in usable condition indefinitely. Complete killing can be accomplished by heating, but has not been economically feasible because of the cost.

* * * *

Two experimenters in America have developed an apparatus by which milk can be subjected to extremely high and violent vibration by supersonic waves generated by an electromagnetic apparatus. Bacteria in milk passed through this apparatus are torn apart and destroyed. The reduction in number is much greater than that achieved by pasteurization, and is approximately perfect. The apparatus is still being developed, and is not yet available commercially. It seems likely to be of great value in India if perfected.

HORTICULTURAL NOTES

CANDIED GINGER

By A. D. Chand

The following method of candying ginger has been successfully employed in our Horticultural Laboratory, and it may be easily practised on a small scale for home consumption.

The first and fore most point to remember is that only fresh ginger should be candied because sugar will not sufficiently penetrate in old, dry ginger.

The following are the directions for making two seers of ginger:—

1. *Preparing the Ginger.*—Wash the ginger properly and soak it in brine for 24 hours. Drain off the brine, wash the ginger, and boil it in fresh water for 10 minutes. Drain off again, and boil the ginger in fresh water for 20 minutes in order to get rid of the excess of salt. Remove the ginger from the water, and, after cooling, peel it nicely. At the same time, break up the large pieces into convenient-sized pieces. Prick the pieces all over with a wooden toothpick in order to facilitate the penetration of sugar. Finally, wash the ginger and put it in a glass jar.

2. *Preparation of the Syrup.*—Not very thick syrup is prepared by adding 2 seers of sugar to 3 seers of water. One-third of the above amount of sugar may be replaced by glucose to prevent the hardening of the ginger and the crystallization of the sugar on the surface of the ginger. Pour the syrup over the ginger when cool. Keep all the pieces submerged in the syrup by placing some weight on top of them.

3. *Thickening the Syrup.*—Drain off the syrup after 24 hours. Thicken it by boiling. After cooling the syrup pour it over the ginger. Leave it for two days. On the third day draw off the syrup. Thicken it again over a fire by boiling. Allow it to cool, and then pour over the ginger. The sugar will then be seen to be partly crystallized. After standing for a further three days drain off the syrup. Boil the syrup again until it reaches the consistency of honey. Cool the syrup, and pour over the ginger. The ginger will then be ready for consumption after it has been allowed to stand in this syrup for another three days. There is no harm if the ginger is allowed to stand longer in the syrup.

Just in case the sugar has not penetrated very well, the same process of thickening the syrup and soaking is repeated.

4. *Drying the Ginger.*—The ginger may be poured into a sieve and the syrup allowed to drain into a receiver placed beneath the sieve. It is better to keep the ginger in the sun or in a warm room to dry. It takes less time to dry if spread in a single layer. It should be dried until it ceases to be sticky. After drying pack in tins and jars.—*(To be continued)*

BUILT-IN COOK STOVES

By Mason Vaugh

One of the popular subjects in these days is that of better living.—Many phases of this subject get attention, but one that is not touched on as often as it should be is that of improving the facilities of the housewife. One of the conveniences most needed is that of better cooking arrangements. Most of the cooking in India is done on small, open fires, wood, charcoal, dung-cakes, or coal being the fuel. The fire is built in little mud fireplaces, and the vessels are set directly on the fire. One fire will usually only heat one vessel, occasionally two, and rarely three, at the same time. The vessels, being directly in the flame, become smutted with soot and dirty to handle, and have to be cleaned by a laborious process of scouring, which not only takes much labour, but results in undue wear on the vessels.

Being directly in the flames of the fire would seem to be conducive to high fuel efficiency. This is not always true; often the flames run above the vessel and are wasted; heating only one vessel at a time means prolonging the time the fire is burning, and increasing the time spent in the operation. In order to neither have too hot a fire, nor too little, the fire requires constant attention. Such open fires also limit the foods possible to be prepared to those which are either fried or boiled ; this accounts for the lack of baked breads, cakes, etc., in Indian cookery.

Even worse that these objections, the open-fire method has the objection of being dirty. The heated air, carbon dioxide, ashes thrown up by the stirring of the fire and the smoke are usually simply allowed to escape into the room and to find their way out as best they can. Much of the dirt settles back on to the furnishings and utensils in the room. The smoke is deposited on the walls and roof, darkening and dirtying them, and, in some cases, causing deterioration of the materials. At least, this makes the room dingy and unattractive, and discourages cleanliness in other directions; at the worst, it adversely affects the respiratory organs and the eyesight, causing discomfort, if not actual ill-health. Some device for improving the kitchen fires of India would contribute immensely to the more cleanly preparation of food and to the comfort and health of the womenfolk.

Kitchen devices.—Devices such as the Primus stove and the Ic-Mic cooker have helped a limited few but have hardly touched the main problem. The Primus and similar stoves have the limitation of cooking only one thing at a time, and so prolonging the cooking time unduly; the Ic-Mic and similar cookers are practically limited to boiled or steamed foods, and so limit the diet,

They also require all things to be cooked practically the same length of time.

The essential features of an improved cook stove or fireplace may be listed as follows: (1) It must be economical of fuel; (2) it should enable more than one thing to be cooked at a time with one fire; (3) the fire should be enclosed and the smoke led outside through a chimney; (4) the fire must be easily controlled; (5) it should be suitable for the fuel locally and conveniently available (excepting dung-cakes, which should not be used because the dung should be used for manure); (6) the stove should be of a size and height to be convenient in use, which for the average Indian woman, means low enough to permit of sitting to cook; (7) in addition to and providing for frying and boiling, it should make baking possible.

Such a stove has been developed at the Agricultural Institute, Allahabad, where most of the quarters have been equipped with it. The stove is built of cement and brick, with certain parts of metal. It consists of an oven 14″×12″×10″ with a firebox alongside of it. Both are covered with a metal plate under which the flames and smoke are confined and conducted to the chimney. By the use of snitable dampers, the flame and smoke can be allowed to go directly across the top of the oven, and to the chimney, or they may be forced to go down the end opposite the firebox, underneath the oven and along the back of the oven, and so into the chimney. The oven is made of 18-or 20-gauge black iron sheets. The joints in the sheets are made by folding the edges together (*dab lagana*). The front of the oven is reinforced with a band of 1″×1/8″ angle-iron around the opening. The door is made of a sheet of iron, with the edges folded twice to a width of about 1″ all round the outside. It is stiffened further by raising a figure as shown by hammering. The door is attached at the bottom with a pair of ordinary butt hinges 2″ long.

The top may be of either of two metals, according to the fuel. Where stone-coal is used, the top should be made of cast-iron. Any local foundry can cast the top, and the oven can be made by practically any tinsmith or blacksmith. If wood is available cheaply and easily, perhaps the nicest top is one of cast-aluminium. The aluminum heats quickly and evenly with a minimum of fuel, is of a clean colour, and is easily kept clean and bright. It is not suitable for use with coal as the excessively hot fire likely to result from careless use would be likely to melt it.

The stove is usually built in a corner. The figures shown have the chimney placed at the right-hand end of the stove, but it can equally well be placed at the left, according to which corner is the most convenient place for putting the stove. Figure No. 1 shows the base of the stove built of brick and cement up to the

level of the bottom of the oven. The location of the oven is also shown. The shaded parts are of brick and cement; the unshaded show the smoke passages. Figure No. 3 shows the section on line A-B, giving the location of the different parts vertically. It also shows the two dampers required. The larger one—No. 2, $6\frac{1}{2}'' \times \frac{1}{2}''$—is installed in the chimney at a convenient height, and is for controlling the draft to make the fire hotter or less, as required. The smaller damper—No. 1—is installed at the end of the oven to control the path of the flames round the oven or direct into the chimney. When it is open, the shortest and easiest path is straight over the top of the oven into the chimney. This allows the fire to burn fiercely for heating the top quite hot, but it will not heat the oven. When baking is to be done, the fire should be first started well and then the oven damper closed, as shown in the drawing. This forces the flames to go across the top of the oven, downward at the end, underneath, and out behind to the chimney, through a separate opening. The passage into the chimney at the back of the oven, shown in figure No. 1, is closed at the top of the oven with the brickwork. The flames thus passing round the oven heat it on all sides. Since they first strike the top, it is likely to be heated hottest. If experience shows that the top heats too much, burning things on top before they cook below, a sheet of asbestos paper or "millboard" can be put on top of the oven.

The firebox construction is not completely shown. Alongside the oven, next the firebox, it is necessary to put an iron plate. This must be of cast-iron if the stove is to burn coal. If the fuel is wood, a piece of iron plate 3/8" thick may be used, though cast-iron is preferable. The front of the firebox is closed at the top to approximately half the height. If coal is to be used, a grate, preferably of cast-iron, is necessary. For wood no grate is needed if the stove is built low down, as shown. Sticks of wood such as are used with the ordinary chula, are simply put in through the hole and pushed further in as they burn, just as is done when cooking over an open fire. If additional fire is wanted, short pieces can be fed in through the lid provided in the top, though this is usually not necessary. If the stove is to be higher above the floor, it will be necessary to cut the wood into short pieces and to use a grate, or at least to cut the wood and feed it through the top, due to the difficulty of supporting long pieces.

Figure No. 2 shows the dimensions of the top plate and of the oven. Generally, only one removable cover is used. It is not necessary to open the cover to cook, except when a very strong heat is required for frying or similar purpose. The whole top becomes heated, and flat-bottomed pans put anywhere on the top will cook nicely. Even when set partly on to the cement, they will

continue to simmer. Chapatis may be cooked directly on the top without using the tawa.

A little experience will be sufficient to enable anyone to get good results. Care in giving fuel and in regulating the dampers will reduce the amount of fuel very much. Generally, the wood should not be cut too fine. Larger pieces, burning more slowly, will give sufficient heat, and will use less. For baking, it is necessary to have the stove hot for some time before closing the damper, and it should be closed and the oven heated for some time before the food is put in. The oven can be used to keep things warm and to cook all sorts of things, in addition to baking cakes and breads.

The cost is moderate.—The aluminium top costs approximately Rs 20. The oven and dampers should not cost more than Rs. 7 to Rs. 8 at most places. A mason will take about two days to install it, and will use one to two bags of cement. The Agricultural Institute can supply the parts if any difficnlty is found in getting them prepared locally; a man to install can be loaned if his expenses are met.

Approximately 20 per cent of the total yield of milk is produced by each fore quarter and 30 per cent by each rear quarter. The yields from the right and left halves of the udder are practically equal.

* * * *

The proper disposal of sewage and other household wastes is vital to the health, convenience, and comfort of the family. Use the septic-tank method. Reprints of an article on this subject are available upon request.

* * * *

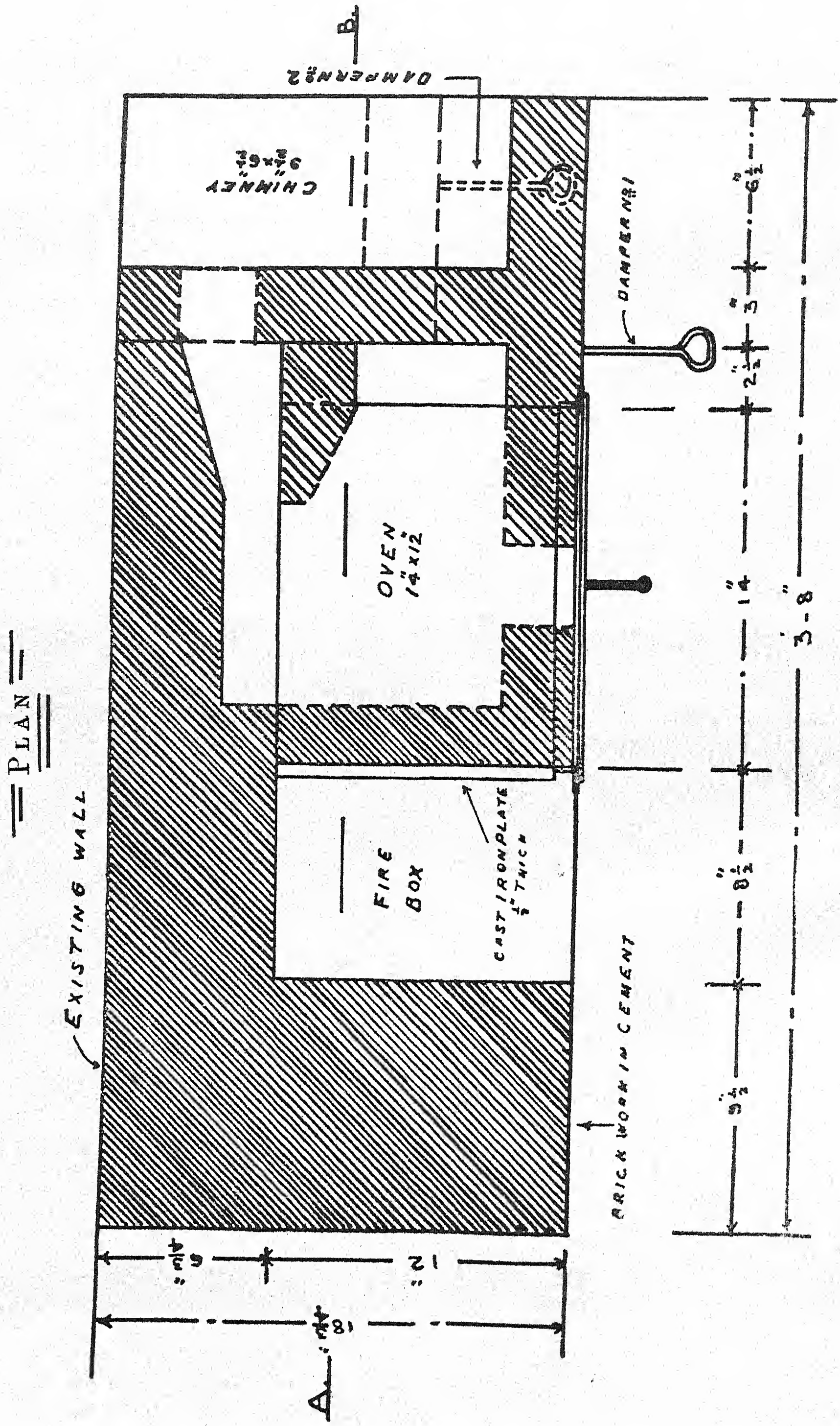
Cotton-seed-meal is a very valuable protein feed for dairy cows: 1 pound of good quality cotton-seed meal-furnishes as much digestible protein as 3 pounds of wheat-bran. Like wheat-bran, cotton-seed-meal is high in phosphorus.

* * * *

Eggs for hatching can be held for one week under ordinary room conditions or in a refrigerator without impairing their hatching power.

* * * *

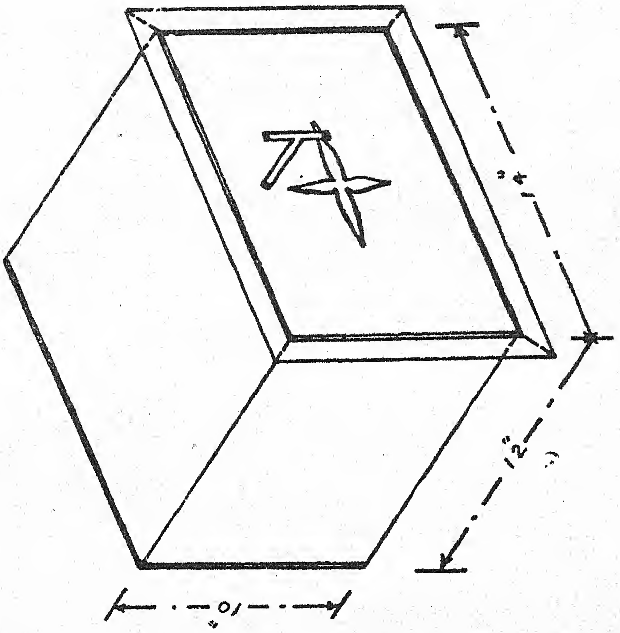
Soil erosion sometimes actually destroys whole fields. Deep gullies leave a field virtually valueless. Destruction can be prevented by a soil-saving dam.



Scale $\frac{1}{2}$ ft. = 1'' in.

Figure No. 1

OVEN



COVER PLATE

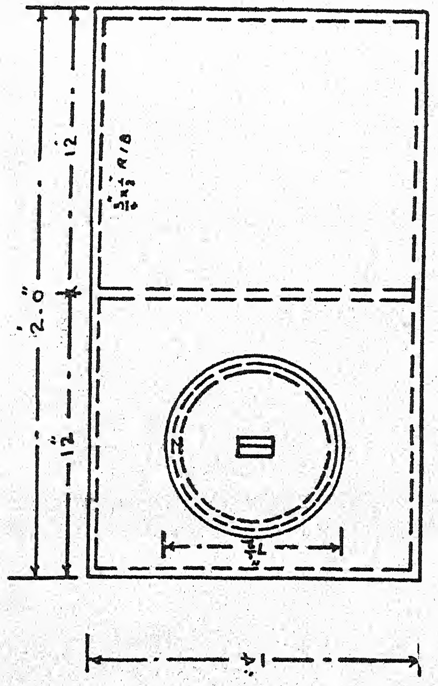
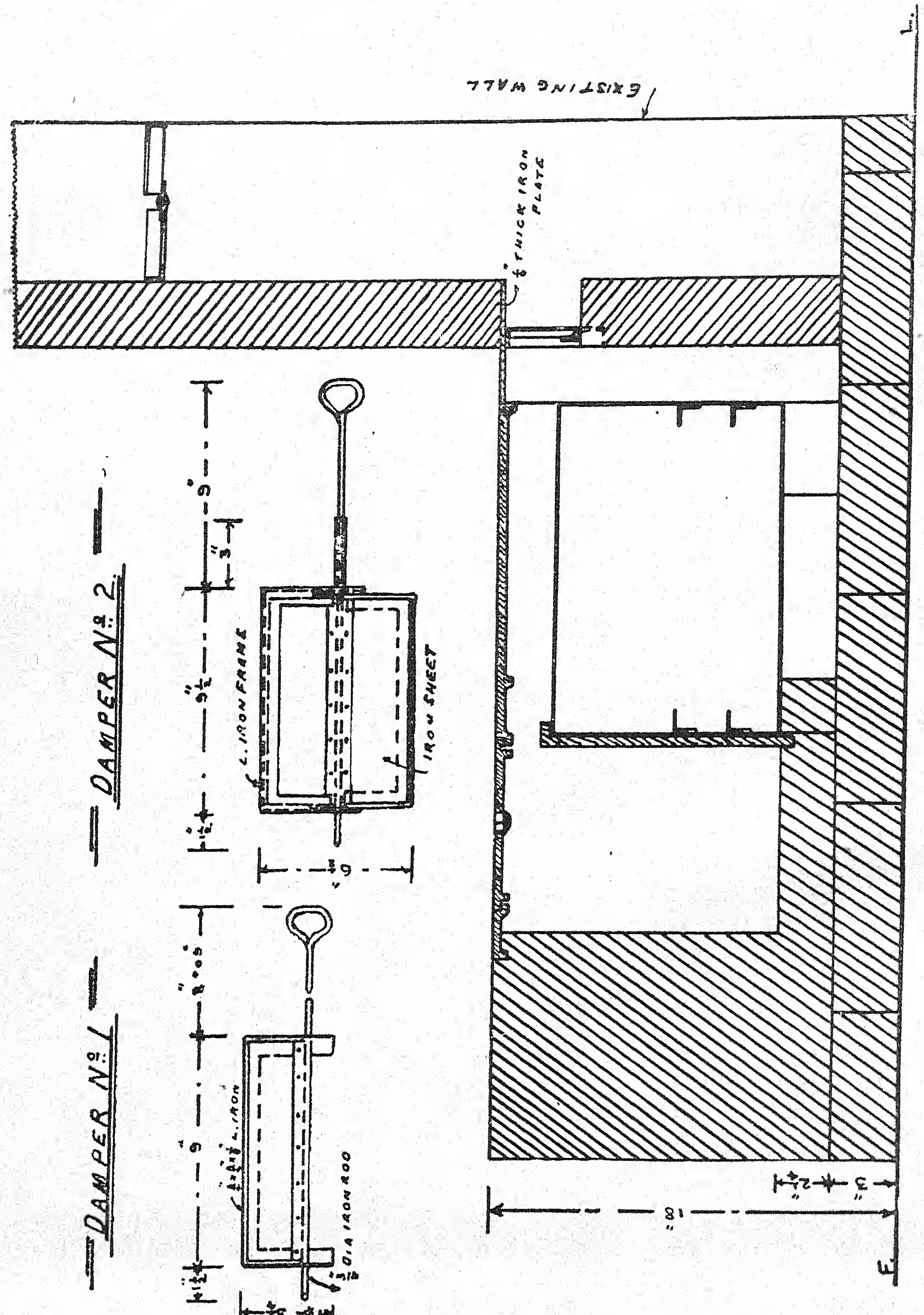


Figure No. 2



SECTION ON A. B.

Figure No. 3

The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE
AND RURAL LIFE

MANAGING COMMITTEE

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The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE
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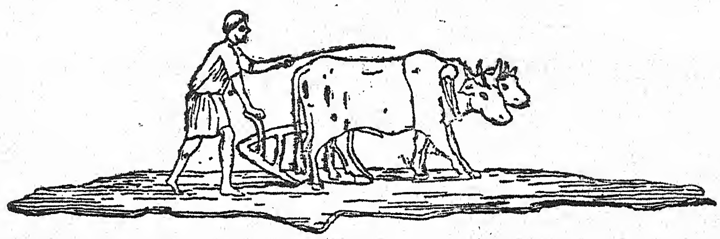

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THE
ALLAHABAD FARMER

VOL. VII.] MAY, 1933 [No. 3

EDITORIAL SECTION

Artificial Production of Rain.

Two American scientists, Professors Warren and Bancroft, have successfully produced rain in a series of experiments based on the natural process which takes place in the upper atmosphere. In the upper atmosphere moisture is always present in the form of minute drops, so light that they remain in suspension. When particles of dust come in contact with the drops of moisture, they are absorbed, thus increasing the weight of the drops. As a result of their electric charge (positive or negative), the particles tend to become aggregated into masses, too heavy to remain in suspension, and then fall as rain. Thus clouds formed of vapour, too light to fall as rain, may be artificially weighted by electrically-charged dust, and immediate rain produced.

Acting on this theory, a load of electrically-charged sand was dropped from captive balloons onto clouds. Rain fell immediately. Professor Bancroft calculates that 40lb. of electrified sand would be sufficient to dissolve into rain one square mile of clouds. In a subsequent experiment, an aeroplane was used carrying sand with a charge, partly positive and partly negative, of 12,000 volts. The machine rose and disappeared among the clouds, while spectators below awaited the miracle, which proved even more dramatic than before. The clouds burst into a violent shower of rain, while, at the same time, the sky cleared and the sun shone again.

In the Netherlands Professor Veraat has succeeded in producing rain over an area of about 8 sq. km. by a similar method, throwing finely-divided dry "ice," i.e., solid CO, from an aeroplane on to clouds. Similar experiments had been tried previously by various scientists using powdered kaolin, but had not given satisfactory results. Professor Veraat rose to a height of 2,500 metres in an aeroplane carrying 1½ tons of "dry ice" and fitted with a special spreading apparatus; he then let the powder fall onto clouds 200 metres below. Abundant rain immediately fell. The experiment was officially controlled by observers in four military aeroplanes. Professor Veraat explains the formation of rain by supposing that during the fall from the aeroplane to the clouds the particles of solid CO become electrically charged and transformed into microscopic drops of liquid CO which cause condensation in the clouds,

and consequently a fall of rain. According to Professor Veraat, this method will also make it possible to ensure fine weather when desired. By converting the clouds into rain early in the day, he holds that a clear sky may be assured in a given locality for the rest of the day.

* * * *

Honey as a Medicine.

"During the current year we have extracted from home and foreign journals many medical opinions on the value of honey," says the *Scottish Farmer*. "We will conclude the series with one by Dr. E. Wagner as published in the best-known German bee paper, *Die Biene*. Honey is a very ancient popular remedy whose beneficent action is derived from the poisons of the bees which it contains. Its activity is precious against bronchial catarrhs, gastric catarrhs, hoarseness, asthma, obstinate coughs, diphtheria, anæmia, illness of change of life, wounds of every kind, inflammation of the eyes, scarlatina angina, abscesses, maladies of the bladder, for every throat affection, inflammation of the pericardium, maladies of the heart in a particular manner, infections of the mouth, inflammations of the gums and conjuctival tissues, erysipelas, redness and inflammation of the skin, and sores of the hands. For the cure of internal ailments it suffices to dissolve a small spoonful of honey in a glass of water and sip this in little doses during the day. For external affections the honey is applied direct by being spread out thin on a piece of lint. In cases of diphtheria, it is taken non-diluted with juice of lemon with a view to killing the infective bacteria. In all other cases, it should be taken diluted. Thus very many maladies can be cured effectively and economically, and even avoided, by the rational use of honey." (*The Veterinary Record*, Vol. XI, No. 52.)

* * * *

Notes on Napier Grass.

Napier grass is said to be common in South Central Africa, but its cultivation as a special fodder crop has come into practice only recently. Its heavy yield of green fodder, its drought resistance, and its palatability mark it with great possibilities as a fodder crop.

Napier grass is propagated by stem-cuttings, roots, or rooted slips. On the Institute Farm planting of Napier has been done mostly by cuttings. The latter should have two or three nodes, and should be taken from mature plants. They should be planted like sugarcane flat and covered with soil. If sowing is done in the rainy season, which is probably the best planting time for this grass, it should be planted on ridges. Ridges can be made with a double mould-board plough or phawra. The distance should be about 3½ feet ridge to ridge. If all the nodes germinate, plants

should be thinned to about 2 feet apart. In months other than rainy ones they should be planted in ditches (furrows). When the plants are about 1 foot high, they can be earthed up again so that the plants are on ridges. They can also be sown on flat ground in rows and ridged up later. Rooted slips should be planted singly in rows. It can be planted at any time, except possibly the very dry months of May and June. On our Farm we required about 1,100 pounds of cuttings to plant one acre.

Napier grass can be grown on any soil, except stiff clay and waterlogged lands. Medium loam is best. Land should be free from weeds and well drained. During the preparation of land for Napier grass the field should be manured with farm-yard manure, 20 cartloads per acre. After each cutting intertillage should be done with a cultivator and the field irrigated. If available, a top dressing of five cartloads of well-rotted manure should be given once a year. A handful of ground castor-cake dibbled round each plant greatly helps.

Napier grass may be cut from three to twelve times a year, giving a yield of from 25,000 lb. to 200,000 lb., or even more, a year per acre, depending on the richness of the soil and on irrigation. Our 1-acre plot of Napier grass planted in the second week of March, 1931, on manured, sullage-irrigated soil yielded about 82 tons (2,200 maunds) of green fodder in a period of six months; i.e., May to October, in four cuttings. The estimated cost of production is 2 annas per maund.

Napier grass should not be allowed to grow too big when cut for feeding. It is highly relished by cattle, as is clearly noticed on the Institute Farm. If it grows a bit thick, it can be cut with a chaff-cutter or ganda and then given to cattle. The oftener it is cut, the better the quality of the fodder and the greater the yield. It also makes good silage.

The Institute can supply Napier roots at Rs. 5, and cuttings at Rs. 2, per maund for planting. For planting, roots are better than cuttings as they stand long transit, delay of planting, and dry season better than cuttings. Cuttings are good for planting during the rainy season. Address the Business Manager.

* * * *

In Reply to Enquirer.

1. There are no seasons in India which exactly correspond to those in Europe. Nor will seasonal operations take place at the same time in different parts of India. Many operations in temperate countries are based on the fact of winter dormancy, whereas most Indian fruits are evergreen. In general, planting of evergreens may best be done during the rainy season; but, where irrigation is easy, the winter is also satisfactory. Deciduous trees should be planted while dormant. The best time for pruning varies with different fruits; very little work

has been done on this problem in this country. As a general rule, prune when there is no fruit on the tree, preferably in winter. Avoid heavy pruning in the spring or summer, such as would expose the trunk or branches to the hot sun. Deciduous trees should be pruned when dormant. In all cases, remember that pruning is a necessary evil, at be kept to a minimum. Prune only when you have a good reason for doing so.

2. Fruit trees fail to bear for many reasons: poor strains, wrong moisture relations in the soil, lack of pollination, low humidity at time of pollination, frost, age, etc. Some trees normally do not set fruit while young; others stop bearing when old. The sapodilla is said to begin bearing at the age of six or seven years. I do not have much experience with this fruit, which is not commonly grown in the U.P. I would suggest that you write to the Horticulturist to Government, Poona, or to the Agricultural Department, Madras, giving as full details as possible. (I have no information about lantana eradication.)—W.B.H.

* * * *

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PRACTICAL HINTS ON VEGETABLE CULTURE IN INDIA

By "Sherrard"

Part 3

(Continued)

Tillage.—Too much reliance is often placed on manures, and tillage neglected entirely. Tons of manure may be applied to the soil, but tillage alone can help to convert it into plant-food which would otherwise lie inert. Tillage alone can cause the manure to function properly by improving the condition of the soil, and there by enable it to conserve and increase heat and moisture, which, in turn, operate on the manure. Almost similar qualifications have been attributed to the application of lime to the soil. Both are true. The relationship between all garden operations are so closely interwoven that without one the other cannot function *properly*. Manure will help to develop the plant, but without lime it cannot operate *properly*. Without tillage neither lime nor manure can operate *properly*. Without sufficient nitrogen in the soil neither phosphorus nor potash can operate *properly*.

All this has been previously explained and so without adequate tillage, all expenditure on rectifying the mechanical condition of the soil, or on copious applications of manure and water, would be reduced to naught. It is only by proper tillage that the texture of the soil can be improved, and it is only by tillage that the plant can make use of the manure provided for its needs. Many regard this operation as only a means whereby weeds are to be destroyed. This is partially true. Weeds draw a considerable amount of nourishment and moisture from the soil, and their destruction is imperative. But this is not the main object of tillage.

Of all farming operations I consider tillage the most essential. In one of my previous publications, in which a Calendar of Operations was introduced, I repeated under each month these words: "Dig and redig all empty beds. Keep all beds constantly forked up." These words were repeated twelve times, and were done so with a purpose. I wonder how many farmers complied with these instructions even twelve times during the year!

It is necessary to know something about mulching and capillary attraction before we can fully appreciate the value of tillage. Capillary attraction is nature's way of bringing up the moisture from lower levels to the surface so as to enable the roots of shallow-rooted crops to make use of this moisture. One soil particle draws up the moisture from the soil particle just beneath it, and in this way the water is passed on to higher levels. Place a small heap of sugar in the centre of a plate and drop a little

coloured water in the plate, just enough to wet the base of the heap of sugar. If you watch carefully, you will see the moisture being drawn up to the topmost particle of sugar. This is capillary attraction. The colour represents plant-foods.

When the soil at the surface is hard-packed and smooth, as it becomes after each watering, it forms an ideal surface for evaporation, thereby permitting the moisture to escape from the land. Any article placed on the land will intercept this evaporation, as you have often seen by the moisture which is held captive beneath a stone, dead leaves, or even beneath matting which has been laid on a damp floor. It is for this reason, and also for providing warmth, that the surface around the roots of plants in Europe and other countries is often covered with a mulch of litter from the stables. This, however, would not be practicable in India due to the ravages of white ants.

By breaking up the surface soil not only do we provide a mulch of dry, loose tilth, but we at once destroy the capillary connection between the surface soil and subsoil, and thereby provide warmth and prevent the moisture being lost in evaporation.

A moist surface does not imply that the condition of the soil is all that can be desired; it only means that the moisture is rapidly evaporating. A dry, finely-pulverized surface with a moist subsoil is the ideal condition, provided that this surface is assured as soon as the soil is in a workable condition after each watering or after rain. Do not wait till the soil is hard-packed, cracked, and crusty; prevent this condition by raking or forking up the surface, thereby ensuring warmth, moisture, and a free access of air to the roots. The admittance of air to the roots, apart from furnishing carbon and oxygen, helps in other ways to disintegrate the soil. Learn to water the plants by means of the hoe or *khurpi*. By conserving the moisture in this manner many a gardener can cut down his water bill to half. Avoid sprinkling a bed. Water it thoroughly, and then keep it there for weeks by frequent and judicious tillage. If tillage is neglected, do not expect manure or water to do penance for this sin: the result will not meet with expectations. The soil itself is the greatest storehouse of plant-foods, most of which lie inert until unlocked by good tillage.

Fallowing.—When one considers how poorly the Indian cultivator manures his soil, it is surprising how his crops grow as successfully as they do year after year on the same land. There is a reason for this. For nearly three consecutive months during the hottest time of the year the ground lies fallow. Nothing is grown, the soil is dry and parched: it is, in fact, baked by the intense heat of the sun.

It is just this rest and the influence of the sun and air on the soil which enables the soil to recoup so readily. They impart a tone and fresh vitality to the exhausted soil. They decompose soil particles and the vegetable matter left in the soil by weeds and the previous crop.

Here is a living example of the necessity for fallowing or resting the soil. Continuous cropping month after month without this rest would be ruinous to any soil, no matter how heavily manured.

This does not imply that the land is left as it is immediately after the removal of a crop. On the contrary, to derive the best results from fallowing, the soil must be constantly stirred, cutting down all weeds and stumps of the previous crop in the process. Here again we find another link in the closely-related chain of operations—fallowing and tillage. When the plots are large enough, the cheapest way to effect this is by ploughing. I have lately seen a most useful plough for the purpose, made at the Agricultural Institute (Naini), Allahabad, named the "Wah-Wah" plough. I understand it is the invention of Mr. Vaugh, the engineer of the Institute. The plough not only stirs the soil, but by its side "wings" it cuts through all the roots of weeds, etc., on both sides of the point to a width of about 8 inches. What is all-important is the fact that the village cultivator can use it with as much ease as his own *desi* plough, and it calls for no more energy on the part of the *desi* bulls to work it.

This breaking-up of the soil presents a larger surface to the sun and air, and through their influence the lumps are broken up to a fine tilth. Without any apology I repeat: "Dig and redig all empty beds." Never let the soil remain idle, even though it be lying fallow. If possible, a month's rest (without idleness) should be afforded to the soil between each succeeding crop. When this is not possible, at least two consecutive months of fallowing each year is essential.

Irrigation.—Whatever the source of the water-supply, successful vegetable culture is only possible when that supply is adequate. The amount required will depend entirely on the nature (retentiveness) of the soil, prevailing weather conditions, and last, but by no means least, adequate or inadequate tillage.

Irrigation should be thorough without being too frequent. When the supply is easily available, the tendency is to give too much, rather than too little. A more thorough soaking is necessary, but overwatering, which will cause the soil to bog or remain sodden for a day or two, must be avoided at all costs. This is not only wasteful, but injurious to the plants.

Given a reasonably good soil, an adequate supply of water should be such that will permit of tillage after twenty-four hours

in hot weather and after forty-eight hours in cold weather. Here again we go back to the previous arguments: proper tillage is dependent on correct irrigation, and an adequate and economical supply of water is dependent on adequate tillage; and so again we find another link in the closely-related chain of operations.

Watering only the surface of beds by sprinkling overhead is positively injurious as it is induces the production of surface-feeding roots which, although they benefit the plant for the time being, are liable to destruction from excessive heat and wind, thereby reducing stem and leaf development and retarding the proper functioning of the reproductive organs, such as flowers and fruits. A thorough soaking of the soil will encourage the roots to go deep down into the subsoil, thereby furnishing a sure safeguard against drought, excessive heat, and hot winds. Moreover, the roots will derive their nourishment from the subsoil where the water has taken the necesary elements in solution.

The burying of chattis or earthen pipes near the roots of plants, and keeping these filled with water, is a means of economizing the water-supply during the hot months, when so much soil-moisture is lost in evaporation. This method is particularly applicable to plants grown at long distances apart, or plants which trail along the ground, such as pumpkin and marrow; watered in this manner, the fruit does not make contact with the wet soil.

As early as possible after each watering, the surface soil should be loosened and pulverized, and all weeds removed. This tillage of the soil should be repeated as many times as possible before the next watering, which should not be given before the *surface* soil shows real signs of drying out, but before the plants show any signs of wilting. Naturally, this condition will present itself sooner during dry hot weather than during cooler weather.

Rotation of Crops.—A regular rotation of crops is necessitated more to soil poisoning than to soil exhaustion. All plants part with a fæcal matter through their roots. This secretion is injurious to plants of their own family. No amount of manure will enable plants of the same family to be continuously grown on the same land without lowering their vitality and decreasing their yield; in fact, after a time it would be impossible to grow the crop at all. Whereas this secretion is injurious to plants of the same family it has no baneful effect on plants of another family. Each succeeding crop should therefore be of a different family to its predecessor.

Not only should the succeeding crop be of a different family, but it should also be of dissimilar growth to its predecessor. The carrot, for instance, though not of the same family as the turnip, should not succeed it, because both have a similarity of growth

below ground. Fibrous-rooted crops should succeed long-rooted crops, and vice versa; potatoes should not follow Jerusalem artichokes, etc.

Below are a few vegetables arranged under their respective families or natural orders. It is easily seen that chillis, for instance, should not follow a crop of potatoes, egg-plant a crop of tomatoes, turnips a crop of cabbages, etc. At a later stage a tabular statement will be given, showing the family group of each vegetable and other information, for easy reference. By consulting this statement, the prudent cultivator will have no difficulty in drawing up a scheme of rotation showing the crops that are to follow in regular sequence on each plot:—

Compositae	*Leguminosae*	*Chenopodiaceae*	*Cruciferae*
Artichoke, Globe	Bean	Beet	Cabbage
„ Jerusalem	Fenugreek	Spinach, English	Cauliflower
Lettuce	Pea	„ Indian	Radish
		Swiss Chard	Turnip

Umbelliferae	*Solanaceae*	*Cucubitaceae*	*Lilliaceae*
Carrot	Chilli	Cucumber	Garlic
Celery	Egg-plant	Gherkin	Leek
Parsley	Potato	Gourds	Onion
Parsnip	Tomato	Kerela	

It is a mistake to allot a certain section of the garden to crops that take a long time to mature because this would mean growing the same crop or crops regularly on the same ground. At least one crop of a different family or nature of growth to its predecessor should be cultivated on the same plot before a crop of the same family as the first crop is again grown on the plot.

Preparation of Beds.—It is presumed that the land has been prepared in a general way, and the plots, paths, and water-channels have been laid out according to the instructions contained in the early part of this series. All that now remains to be done is the preparation of each individual plot to receive the seeds or seedlings. This preparation of the plot will depend entirely on the crop it is to receive. In the previous chapter several methods of sowing and planting have been shown, and the treatment of each plot will be governed entirely by the method required for the crop concerned.

As far as possible, only one crop at a time should be accommodated in each plot. For small gardens these plots should therefore be made of convenient dimensions to suit individual requirements. It may sometimes happen that a single plot is required to accommodate more than one crop at the same time, each crop requiring a different method of preparation of the land. Though modifications

can be made to accommodate these crops in the same plot, I repeat, it is preferable to have a separate plot for each crop, otherwise rotation of crops becomes impossible.

In the accompanying diagram (diagram 2) a single plot is shown improvised to accommodate three different crops, each requiring a different method of sowing.

Before describing the different methods of preparing the plot I must first stress the necessity for deep digging. Deep digging encourages the roots to go deep down into the subsoil—the necessity for this we have already learned. Root-action and root-development being encouraged thereby, all growth above ground is also benefited, resulting in marked improvement to the crop. The irrigation water is the more easily carried down to the subsoil, where it remains to be drawn upon by the plant by capillary attraction when there is no water in the surface soil. Deep digging benefits the plants in many ways; air finds its way readily to the roots thereby supplying the essential elements—carbon and oxygen. A thorough mixing of the soil is thereby assured; the complete disintegration of the soil, the action of the sun on the lower depths, etc., all play a very important part in improving soil fertility, and thereby improving the crop.

Method A.—This is known as the *flat* system. Divide the *plot* into *beds* 5 feet wide, by narrow "feeder" paths, 18 inches wide, placed across the width of the plot. These paths will provide means of easy access to the beds, and will facilitate weeding, tillage, etc., without the necessity of having to enter the bed itself. Each alternate feeder path is converted into narrow water-channels by scooping out the centre. Thus between two beds will run a channel for irrigation and between the next two a path diagram 2).

Dig up these beds to a depth of one foot or 18 inches and thoroughly pulverize the soil. Subdivide these beds into smaller beds any convenient length (say 10 feet) by narrow ridges or *bunds* placed across the bed. This is merely to facilitate equal distribution of irrigation water over the surface.

Now spread a 2-inch layer of well-rooted manure over the surface of each bed and dig this into the soil. Level the surface, and the beds are ready to receive the seeds or seedlings.

Where tractors are employed, or deep ploughing is resorted to, the whole plot should first be ploughed and the beds, water-channels, etc., made subsequently.

Method B.—This is the *ridge* system. The whole plot is dug over to a depth of 1 foot. Level the entire plot and manure it as described for the beds of the *flat* system. Now across the width of the plot draw parallel lines 1 foot apart. These lines should run north and south to enable the rays of the sun, when travelling from east to west, to penetrate between the rows. This is essential.

Dig out the earth between the first two parallel lines to a depth of 3 inches and heap it up between the next two parallel lines so as to form a ridge across the plot with a width of 12 inches at the base, 6 inches at the top, and 6 inches in height. The top of the ridge should be flattened out as shown in diagram 3. Continue in this manner throughout the plot, making a series of ridges and furrows alternately. The furrows thus formed by the removal of the earth provide passage for the irrigation water, whereas the ridges will accommodate the seed. The irrigation water should not be allowed to flood over the ridges. The seeds or plants will draw upon their supply of moisture by capillary attraction. This method is applicable to the cultivation of carrots, turnips, beets, etc., during rainy weather and in moist soils.

Method C.—This is the *raised bed* system. The raised beds are prepared in the same manner as the ridges of the *ridge* system, but the ridges and furrows are made wider. Beginning at one end, parallel lines are drawn across the plot 15 inches apart; a space of 24 inches is then left, and another two parallel lines 15 inches apart are drawn across the plot, and so on throughout the whole plot. The earth between the two lines 15 inches apart is dug out to a depth of 4 inches, and this earth heaped up between the lines 24 inches apart to form raised beds of that width (diagram 4).

This is a useful method for growing sweet potatoes and Jerusalem artichokes in localities with a heavy rainfall or on damp soils. The tubers are planted out along the centre of the raised beds in a single line. This method is also recommended for cauliflowers, cabbages, etc., in districts where rainfall is excessive or the soil damp. These plants are planted along parallel lines drawn each side of the bed 3 inches away from the edges. The plants should not lie opposite each other, but should be located equidistant from two opposing plants, thus:—

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+         +         +         +
     +         +         +
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Method D.—This is the *trench* system. The plot is ploughed or dug up to a depth of 3 or 4 inches and levelled. Commencing at one end of the plot, two parallel lines 2 feet apart are drawn across the width of the plot from north to south. Space out the required distance between rows and draw another two parallel lines across the plot, and so on throughout its entire length (diagram 2).

Dig out the earth from between the two parallel lines to a depth of 1 foot and place the earth on the sides. Loosen the earth at the bottom of these trenches to a further depth of 6 inches by digging over the earth, but without removing it. Now fill in the trenches with the earth at the sides to within 8 inches of the

top. Into these partly-filled trenches throw in manure to a depth of 3 inches and dig it into the soil below to a depth of 6 inches. Fill in the remainder of the earth to within an inch of the top and flood the trenches with water to cause the earth to settle. When sufficiently dry, rake up the surface and level off with additional earth to within 2 inches of the surface, thus making a series of *shallow trenches* throughout the plot. These trenches are now ready to receive the seed.

You will note that about 6 inches below the surface there is a rich mixture, 9 inches deep, of earth and manure. The roots of the plants will gradually penetrate through the surface soil and plunge themselves into this rich mixture. Herein lies the secret of success with plants such as peas and beans to which this method is applicable.

Method E.—This is the *pit* system. Pits 2 feet wide and 2 feet deep are dug at regular intervals 3 or more feet apart from centre to centre. These are then filled in, manure being added, as was done for method D, and the pits finally saturated with water to induce settlement of the soil. When sufficiently dry, the surface is loosened and levelled ready to receive the seeds or plants. This method is used for pumpkins, marrows, etc., the distance from centre to centre varying according to requirements.

Sowing and Planting in the Open Ground.—Seeds are divided under two heads, each belonging to a distinct *class*—

Class I.—Those seeds which are first sown in pots, pans, or nursery beds and the seedlings transplanted into the open ground; and

Class II.—Those seeds which are sown right away in the position they are to occupy in the garden.

For detailed instructions in seed-sowing the reader is referred to Captain W. Sherrard-Smith's book, "Practical Hints on Flower and Vegetable Culture in India."

Different vegetables require different methods of sowing and planting. In the Tabular Statement of Information which is to follow the *class* to which the seed belongs, and the *method* of sowing or planting, will be shown. These methods will be referred to as A, B, C, D, and so on; a short description of each method will will be given here:—

Method A.—When the beds have been prepared, as instructed in the previous chapter, parallel lines are drawn across the bed, at the required distance apart, from north to south. These distances will vary according to the requirements of the crop, and will be shown in the Tabular Statement. The seedlings resulting from class I sowings are planted in position along these lines, while seeds belonging to class II are carefully sown along the lines, and the resulting seedlings *thinning out* to the required distance

apart. This thinning-out is not done all in the one operation. Supposing the plants are to be thinned-out to 9 inches apart. When they are an inch high, pick out the weakest seedlings, leaving the others 3 or 4 inches apart. A couple of weeks later a few more intervening seedlings are picked out until finally all but those at the required distances are removed. Never permit two plants to grow where one is desired; the *mali* will always err in this direction. This principle should govern all thinning out operations.

The greatest error in all seed sowing is in sowing too thickly; this is not only wasteful, but injurious, to the resulting seedlings. Very fine seeds should first be mixed with sand three or four times their own bulk; this will permit of a more even distribution; larger seeds should be mixed with sand twice their own bulk, while still larger seeds should present no difficulty in fairly even sowing. Seedlings from the tiniest seeds, when correctly sown, should not show up closer than an inch apart; while large seeds, such as pea and marrow, should never be sown closer than 6 inches apart, and even then may require thinning out.

Seeds of class II may also be sown broadcast, i.e., scattered over the surface of the bed; but the method has many disadvantages, and is not to be recommended. The *mali*, who always takes the line of least resistance, will invariably use this haphazard method. A little trouble in drawing the parallel lines will be amply rewarded if only by the neater appearance of the bed. Sowings in parallel lines will greatly facilitate all garden operations, such as thinning out, tillage, watering, collecting the crop, etc.

Method AI.—The beds are prepared, and the sowing or planting done in exactly the same manner as described for method A. The plants, as they grow, will, however, require *earthing-up*. This is the process of drawing up the earth from between the rows and heaping it up against the stems of the plants, thus converting the space between the rows into "furrows," and the lines on which the plants stood into "ridges." This earthing-up should be commenced when the plants are about half grown. Every time the soil is tilled around the roots of the plants, the ridges are built up a little higher. The irrigation water is run along the furrows.

Method B.—Parallel lines are drawn along the flattened surface at the top of the ridges, each line about 2 inches away from the edges, and the seeds sown along these lines. During the process of *thinning out* care should be taken to see that plants do not remain immediately opposite each other.

Method BI.—The ground is prepared in exactly the same manner as for method B; but, instead of sowing or planting along the ridges, the plants are placed along the furrows in a single line. As the plants develop, the ridges are cut away and the plants

earthed-up with this soil, this being a modification of methods AI and B.

The irrigation water is first run into the original furrows in which the plants stand, and, after *earthing-up*, into the newly-converted furrows.

The method is only applicable to planting and sowing during dry weather, or in very dry districts, for, should there be heavy rain while the plants stand in the furrows, they are likely to be waterlogged.

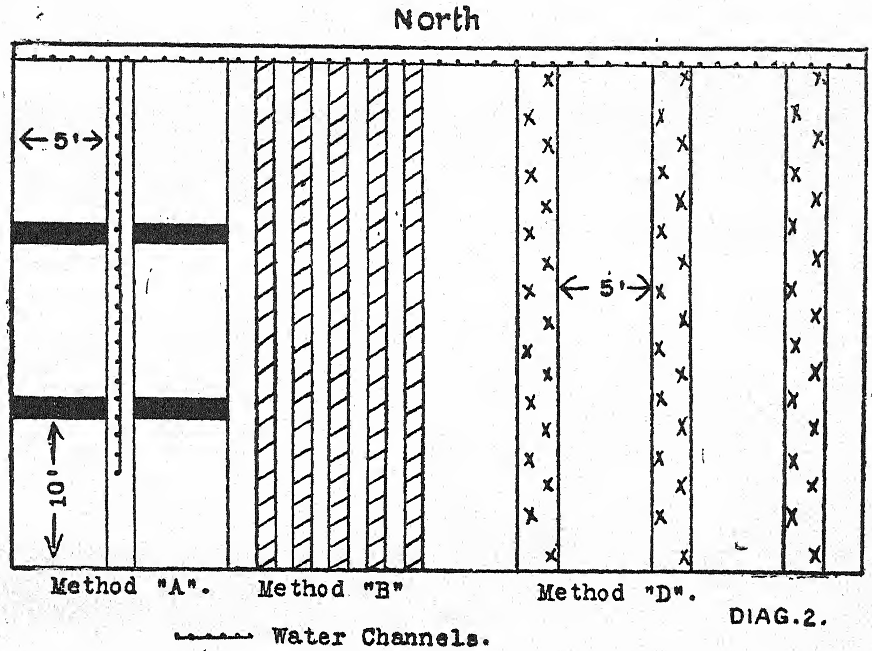
Method C.—As explained in the previous chapter, in this system the sowing or planting is done either in a single or double line on the raised beds according to the requirements of the crop.

Method D.—Draw parallel lines a foot apart along the trenches, each line 6 inches away from the sides. The seeds are sown along these lines about an inch below the surface. This method of sowing is used for peas, beans, etc. Single seeds are dibbled in at the given distances; but they should not lie opposite each other in the same trench (See diagram 2: the crosses represent the position of the seeds). When this method is used for seeds of class I (as globe artichoke, asparagus, etc.), the seedlings are planted in a single line down the centre.

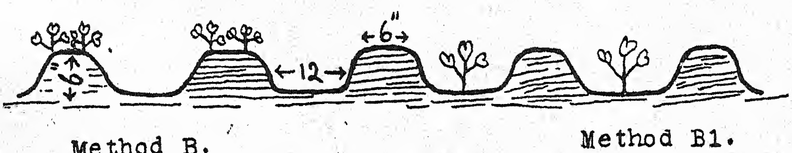
Method E.—Three or four seeds are sown about 6 inches apart in the centre of each prepared pit and the seedlings thinned out to a single plant. If seedlings are used, these are planted singly in the centre of each prepared pit.

Cattle-breeding operations in the United Provinces show progress under the charge of a special Deputy Director. The following statement shows the progress made and the extent of these operations:—

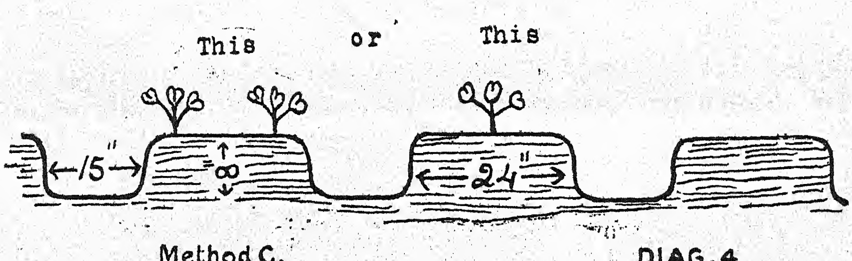
	Number of bulls issued	Total number of bulls at stud in the province
1922-23	46	239
1923-24	72	301
1924-25	79	312
1925-26	100	374
1926-27	262	597
1927-28	635	1,186
1928-29	815	1,947
1929-30	568	2,341
1930-31	639	2,731
1931-32	555	3,015



DIAG.2.



DIAG.3.



DIAG.4.

CONTROL OF BURROWING PESTS

By S. R. Misra

All rodents, such as rats, mice, porcupines, ground-squirrels, ants, etc., rank themselves as farmers' enemies. Their effective control forms quite a big problem in certain localities. For a long time field rats have been known to do considerable damage to standing crops, besides their being a serious pest in and around homes and godowns. Reports appear from time to time of rats being a serious menace to agriculture in certain areas in the United Provinces. Last year, in March, we had a local official call for help for demonstrating our control-measures in Bamrauli village, about five miles west of Allahabad, where hundreds of bighas of standing crops were devastated by field rats. The farmers and local official people there had exhausted all known methods and medicines against them, to no success. Our man conducted a successful practical demonstration with Cyanogas "A" dust in the above village for over two weeks. Formerly, we had to employ two night watchmen for watching our potato fields against porcupines, yet about one-half to one acre of potato was damaged every year. We put one man regularly on treating with Cyanogas all rat and porcupine holes on the farm and all neighbouring orchards, bare grounds and bushy places, and the railway line sides around the farm. As a result of that, we have dispensed with night watchmen costing about Rs. 100 every season.

For killing godown or grain store rats there is nothing like carbon bisulphide. Rats or mice are much more susceptible to carbon bisulphide fumes than weevils. A dosage of carbon bisulphide which will kill only 10 per cent of weevil will kill 100 per cent of rats if they are not allowed to run off. At the least smell of the carbon bisulphide fumes they at once try to run out of the room; but, if all the windows, doors, and outleading holes are carefully shut, in a few hours all of them will be seen lying dead. Carbon bisulphide can also be used in treating rat holes in homes and godowns by putting some cotton or rags wetted with it deep into the burrows and then covering the hole with earth.

Cyanogas "A" dust is a grey powdery material used for killing all rodents and vermin. In contact with moist earth it liberates its gas, which is a deadly poison. This material is pumped into holes with a small foot-pump which can be purchased for about Rs. 20.

Rats.—After the pump has been loaded with Cyanogas "A" dust, the delivery tube is put deep into the rat hole or burrow and moist earth is well pressed round the tube and then pumping commenced. After two or three deliveries or pumpings, the gas seems emerging from different points, which shows that the hole which is being treated is connected with many holes. All such

connected holes should be closed with earth and then pumping begun again. About ten or fifteen deliveries are enough for one hole or hole system.

Mole Rats.—The difficulty with mole rats is that they do not leave open burrows, and treating often becomes futile unless holes are opened up at intervals on the connected burrows or runways and treated. The rest of the procedure is the same as for treating rat holes.

Porcupines.—Porcupines make deeper and bigger holes than rats. About one ounce or half a chhatak of the dust should be put in deep into the hole with a long-handled spoon and then the hole closed up with mud. Other connected outlets must also be closed with wet earth to retain the gas. Jackal and wolf holes can also be treated as are those of porcupines.

If the rats or porcupines are present in the holes when treated, they can be seen lying dead in the holes if dug a little later. It is better to treat fresh holes, which it is easy to know in the case of rat holes, but it is not so easy in the case of porcupines. It requires a little experience and vigilance to know if and when the porcupines or rats are in. It is paying to treat large rat-infested areas systematically; that is, have two or three pumps working together from one end to the other. As Cyanogas "A" dust liberates its gas in the presence of moisture, so, before pumping, water should be poured into the holes to make them moist if they are dry, especially in summer. Cyanogas is cheaper to use on a field scale, but it is *not safe* to use it in or around homes, for which carbon bisulphide is most suitable, but too expensive for field holes.

Cautions.—The operator, while pumping, must stand on the windward side to avoid breathing in escaped gas. Avoid touching the material with the hands. Wash the hands after operating the Cyanogas. If its gas has been breathed in by chance, inhale some ammonia.

Cost of Treating with Cyanogas "A" Dust.—We got 75 lb. Cyanogas "A" dust from Shaw, Wallace & Co., Calcutta, for Rs. 116-10, including freight, which comes to about Re. 1-9 per pound, or Rs. 3-2 per seer. Its cost of treating per bigha or acre varies widely, depending on the number of holes treated. It may be from one anna to one rupee or more per bigha. Last year, when it was demonstrated in Bamrauli village, it came to about one and a half annas to treat a bigha. That area was heavily infested with rats. Generally, it is much cheaper to treat holes in standing crops than on bare lands, but probably the best time for treating field holes is just after the crops are harvested. About 150 to 200 rat holes can be treated with one pound, or half a seer, of the dust. It takes more to treat porcupine holes.

PROBLEM OF BULLOCKS IN THE JAIPUR STATE

By H. T. Gogate, I.D.D., Jaipur

"Bullocks form the backbone of Indian agriculture," is a common saying, fully realized by all in India. The possession of good bullocks is a prime necessity for efficient agriculture. Bullocks found with the Jaipur State cultivators are generally very poor in quality. The breeding of good bullocks is almost unknown to the Jaipur cultivators, and most of the bullocks used for agricultural purposes are imported into the State. This annual import is near about 30,000. Calculating the average price of a bullock to be Rs. 50 the Jaipur State has been sending out Rs. 15,00,000 every year, and this is all from the pockets of the poor cultivators. This drain of money is very great, and affects the prosperity of the public in general, and the State in particular. I may therefore be allowed to submit my views on the subject.

The cultivators of the State, when advised to breed good bullocks, generally complain of a want of sufficient fodder in the State, the high assessment on land, their poverty, which precludes their incurring any additional expenditure on cattle-breeding, and so on. There does not appear to be much truth in these complaints. In the Jodhpur State agricultural conditions are more unfavourable than in the Jaipur State, yet the cultivators there not only produce all the bullocks required for their own purpose, but also export a large number of bullocks to the Jaipur State and the United Provinces. It is probably the export of bullocks which is greatly helping the cultivators to maintain themselves, and bring a substantial income to the Jodhpur Durbar in the form of export duty. There is therefore no reason why the production and export of good bullocks should not be possible in the Jaipur State as well.

The following are the main reasons for bullocks not being raised in the Jaipur State:—

(1) The cultivators do not properly feed their cattle; (2) good bulls are not available for breeding purposes; (3) there are no veterinary facilities throughout the State, hence the rearing of cattle appears to be risky to the cultivators; (4) indiscriminate breeding, especially in-breeding; (5) bullocks do not fetch a fair price; and (6) good bullocks belonging to the United Provinces cattle dealers can be had by the Jaipur State cultivators in exchange for two or three inferior bullocks raised without expenditure to the owner.

The Jaipur State has opened an Agricultural Department which, among other activities, has undertaken the work of cattle-

breeding. In due course, that department hopes to get sanction to sell its bulls at cheap rates within the reach of the poor cultivators. A State-wide veterinary organization is also essential for pushing on the cattle-breeding work in the State, but this work involves on expenditure of thousands of rupees. Hence the Durbar will have to find ways to increase the income to cover the additional expenditure to be incurred upon the proposed veterinary organization. The main suggestion of this article will probably solve this problem as well.

Regarding the other causes of the absence of the breeding of good bullocks in the Jaipur State, the writer may be permitted to make the following suggestion to promote the breeding of good bullocks. The suggestion is that the Jaipur Durbar should levy a high duty on the import of bullocks. Apparently, this might seem to be impracticable for fear of public opposition. It is the aim of this article to educate public opinion in favour of raising the import duty on bullocks.

Higher prices of bullocks would afford a great inducement to the cultivators to raise good bullocks. At present, even good bullocks fetch poor prices. In fact, the prices fetched do not even cover the actual cost of production in the Jaipur State. Hence it is that the cultivators are indifferent towards raising their own stock in the proper way. High import duty will result in higher prices of bullocks, which will automatically induce many cultivators to breed better bullocks so as to raise their income by the sale. On the other hand, having to pay higher prices in a lump sum would lead cultivators to pay more attention to raising suitable bullocks at home.

Proper feeding is a vitally important part of good breeding. It would therefore be desirable for the Jaipur Durbar to take such steps as would make the cultivators pay more attention to the feeding of the home stock. If the import duty is high enough to put the purchase of bullocks raised outside the State beyond the reach of the ordinary cultivators, they will cease to depend upon the purchase of foreign bullocks. At present, most of the Jaipur State cultivators go to the cattle fairs every third or fourth year and purchase a pair of bullocks costing about Rs. 100 or so. The financial condition of the cultivators makes them borrow this amount from the money-lenders, who charge them a rate of interest that will secure for them a return of double or treble of the amount lent. The high prices of bullocks resulting from the import duty are likely to minimize the borrowing of large sums, and thus largely save cultivators from the clutches of the money-lenders so far as loans for bullock purchases are concerned. In time the cultivators will come to realize that the amount which was paid in instalments for paying off the debts, if spent on the

feeding and care of the home stock every day proportionately, will produce a superior stock of cattle.

Regarding the sixth reason mentioned above, it must be said that the practice of exchanging two or three home bullocks with one good foreign bullock affects cattle-breeding in the Jaipur State very adversely. Bullock traders purchase bullocks in the cattle fairs of Ajmer and Jodhpur State at cheap prices and take them to the United Provinces by the Jaipur State roads. When they are on the way with their cattle, the Jaipur State cultivators exchange with them two to three bullocks of inferior type belonging to themselves for one good foreign bullock. The bullocks given in exchange are generally of the same age as those received in exchange, but have to be given away because of their unfitness for agricultural work resulting from the cultivators' indifference toward their breeding. Cultivators are indifferent merely because they know that one good bullock can be had in exchange for two or three raised without expenditure. The proposed import duty will make it forbiddingly expensive for the United Provinces traders to pass through the State with their bullocks. The State cultivators will thus be forced to depend upon the bullocks raised in the State. This will make them pay more attention to better feeding and using well-bred bulls.

This apart, import duty will, in all probability, raise the requisite funds for the veterinary organization in the State, but its main advantages are that it will discourage the import of cattle and push on the bullock-breeding industry in the Jaipur State. The Jaipur State is nearer to the United Provinces than the other bullock-breeding centres of Rajputana; therefore there are great possibilities of gradually developing the bullock export trade both to the benefit of the cultivators and the Durbar as well. Increase in the export trade will result in a corresponding income to the State.

It may not be out of place to mention here that Holstein, Jersey, and Guernsey cattle became the best breeds of cattle in the world after the import of cattle in their native places was completely prohibited. In India also the Mysore Durbar has prohibited the import of cattle, and has succeeded in improving the Amrit Mahal breed.

The importance of common salt in the feeding of farm animals has been known for centuries. The cow requires a daily amount of salt from 0·75 to 1·5 ounces.

* * * *

The whole of the dairying industry is intimately bound up with the sanitary quality of the milk produced. Dirty pails are the greatest single source of contamination of milk.

SOIL EROSION

By S. C. Chowdhery

"The greatest mechanical economic loss from which India suffers is the loss of fertile soil by erosion. As one travels up and down India, he cannot fail to be impressed, as he approaches watercourses and rivers, with the marks of erosion. Sometimes the eroded land takes on the nature of "bad lands." I think of stretches of the Punjab along the Jhelum, I think of stretches along the Jumna in the United Provinces, along the Chambal in Central India, along the Narbada, and along the Krishna. In many parts of Central India formerly there was sufficient soil above the rock to guarantee for all time, as long as the soil remained, abundant crops. But in many places several feet of this good soil have been washed away, leaving bare rock. The loss by erosion means a depletion of the farmers' most valuable asset. Soil is the most important integer of his capital. Without no crop is possible. The soil that is now being lost by erosion has taken unbelievably long periods of time to put into its present position. It is now being lost to the value of crores of rupees every year. India, through neglect, is losing its birthright."*

Soil erosion is the greatest destroyer of soil fertility. It ruins the land—much of the soil reserve of plant-food is washed away, much damage is done to irrigation, water-power is lost, it interferes with navigation, and it interferes with farm management. So the importance of taking every step to combat soil erosion cannot be overestimated. It is to be regretted that a large number of farmers appears to be quite incapable of being appreciative of the extent to which their farms are suffering from soil erosion, and one is inclined to think that the reason for such a state of affairs is that erosion appears to such individuals to be a word, rather than a fact; or, if a fact, to be of academic, rather than practical, importance. With this thought in view, it seems desirable to explain briefly the natural and general erosion which has been taking place for centuries and which is to-day still occurring.

General Natural Erosion.—Erosion may be simply explained as the breaking-down of the materials forming the surface of the earth, and the movement of such material from one place to another. The breaking-down or weathering of the earth's surface is carried on by a number of agencies, *e.g.*, temperature, lower forms of life, air, and water; and it is with the last two named that we are concerned. All land surface areas pass through a cycle of general erosion, which results in the appearance of the peculiar physical features with which one is familiar. An exam-

*Dr. S. Higginbottom—*The Allahabad Farmer*, Vol. VI, No. 2, April, 1932.

ple will explain how it happens. A plain is elevated above the general level of the surrounding country, possibly by volcanic eruption, and this plain is in an uneroded or undenuded state. Gradually, as a result of the drainage of rain-water, small gullies are formed which slowly, but steadily, increase in size until the original plain becomes a mass of hills and valleys. This is what happens to cultivated lands when erosion takes place. A small gully is first formed; and, owing to the increase in the speed of the water as it drops into, and runs down, this gully, the sides are eroded and the gully widens and deepens. Small hills and valleys are formed, the hills being actually ridges in a field and the valleys the small gullies and depressions occurring on cropped lands. The land remains quite unsuitable for growing crops for a great number of centuries.

Æolian Erosion.—As well as water, wind is also an agent working for nature in the group of eroding agents. Such erosion by wind is termed Æolian Erosion.

The wind is one of the agents of erosion, which means that it is engaged in removing, transporting, and depositing rock fragments and dust particles. The transportation of dust by wind is well known, and the fineness of the particles transported is recognizable by the fact that dust is deposited in every place to which a current of air has access. Wind erosion is operating with greater or less effectiveness in all climates and regions, but it is least effective in humid regions, especially where clothed with vegetation. Moisture, by increasing the cohesion of the particles of earth, prevents their being removed by wind action, and so the maintenance of good water content in the soil is highly important in preventing æolian erosion.

There are four different land surfaces on which wind erosion is most effective. Let us look to them in brief—

Wind Erosion in Humid Lands.—Where vegetation densely clothes the land, the loose, disintegrated rock is held in place and protected. Yet, even here, strong winds now and then overturn trees, and winds of hurricane force may plough a path through the forest, even carrying the trees away bodily. The overturning of the trees moves rock fragments, which are then exposed to the winds; but this is a minute effect.

By his occupation of humid lands, man has created opportunity for the operation of the erosive work of the winds by the removal of the forest and by ploughing.

Wind Work on Mountains.—Lofty mountains are exposed to strong winds for they rise into the rapidly-moving upper air currents. These winds readily move light materials, such as snow and rock fragments. The work of the wind is aided by the absence of vegetation and the slope of the land.

We have no measurements for the determination of the rate of the work of wind in such a situation, and it would be difficult to measure in any event, since it is but one of the several processes which are at work reducing mountain elevations.

Wind Work on Seashore.—Portions of the sea-coast are especially favourable to effective wind work, for there are three favouring conditions—

(*a*) an abundance of sand thrown by the waves;
(*b*) absence or spareness of vegetation; and
(*c*) the rapid drying out of the loose sand.

Formation of Sand-dunes.—With an abundant supply of dry sand having little or no vegetation to hold it in place, the wind readily moves the sand before it, sometimes lifting it well above the surface, but more commonly drifting it along with the accompanying development of ripple-marks. These sand movements are most effective under the influence of drying winds, which need not necessarily be more strong than the damp winds. Very violent winds whirl the sand before them, and are even able to pick up and transport shells and shell fragments.

The sand is drifted in any direction that the wind may happen to be blowing; but, since the great majority of the winds blow either on shore or off shore, either diagonally or directly, the chief sand movements are either landward or seaward. In the latter case, the sand comes within the reach of the waves to be thrown back again, but in the former it accumulates on the land back of the beach. Here the tendency of it is to form a narrow strip of low sand-hills called sand-dunes. In their highest portions the dunes are commonly not more than 50 or 75 feet, and often much less, but they may reach heights of 200 to 300 feet.

Wind Work in Deserts.—Extensive areas of the earth have a climate so dry that only sparse vegetation grows, and in some places it is dry that vegetation is almost absent. In such arid regions the soil exposed between the sparse vegetation is almost permanently dry; it is therefore subject to transportation by the winds, which are often very strong.

Normally, the loose soil is slowly drifted about, keeping close to the ground, and tending to accumulate around obstacles such as well-rooted plants.

Now and then, in the drier regions, fierce winds sweep over the surface, and then the loose, fine-textured soil is raised in clouds of dust which so fill the lower air as to completely shut out distant objects from view. In deserts these sand-storms assume to be dangerous to life. Extensive deposits are made, the local topography is altered in detail, and paths and trails are completely obliterated.

Erosion by Water.—In order to understand this particular phase of soil erosion, we should, at the outset, make a consideration of such factors as silt in rivers, the run-off of rain water, and the effects of vegetation.

Silt.—All running water on the earth is carrying a load of mineral matter, though the load varies greatly from one stream to another, and from time to time in the same stream. This mineral load is carried in fragmental form. The former is the chemical load which is invisible, the latter the mechanical which is visible.

By far the greater proportion of the chemical load of rivers is supplied by underground water which brings to the surface a great variety of mineral substances in solution. It has been calculated that the Thames transports 548,000 tons of mineral matter each year.

Besides the chemical load contributed by the underground water, there is an addition to the supply obtained by the surface water itself. Ordinarily, this contribution is slight, and its amount depends upon the composition of the water and the nature of the rock or soil. Water impure with organic acids will dissolve more than purer water, and river-water is often charged with these and other substances.

The mechanical load is essentially a contribution from the surface. Some of it may fall to the river from steep slopes; some is worn from the river-bed by the attrition of the rock fragments against the stream bottom. But the greater portion of tne mechanical load of rivers is washed into the stream by the multitude of tributaries and by the huge amount of run-off water, which finds access into the river.

Silt is the very fine earthy material carried in suspension in the water; and, although it has a tendency to fall toward the bottom of a stream, it is prevented from doing so on account of the smallness of the particles which allows them to be lifted by the numerous eddies always present in a rapidly-flowing stream of water. But some streams are so heavily burdened with sediment that they cannot carry it all, and are overburdened. Such streams are forced to steadily lay down some of their burden in the stream-bed, building it up.

The amount of silt transported by a given quantity of water flowing at any given speed is to an extent limited as every increase in the stream's load causes a corresponding decrease in its carrying power. It has been observed that a current of half a mile an hour will carry coarse sand, while a current of two miles an hour will move angular stones the size of an egg. The transporting power of water varies as the six power of the velocity so that, if the velocity of the current is doubled, the power of transportation is increased 64 times.

By the rivers the land is drained, and accompanying this drainage is the transportation of a vast quantity of soil and plant-food materials, some in solution, some in suspension, and some dragged down along the river-bed. It has been calculated that the Mississippi pours into the Gulf of Mexico 19,500,000,000,000 cubic feet of water each year which carries with it about 812,500,000,000 pounds of soil and rock fragments. "This vast amount of sediment, if collected, would form a prism a mile square and 268 feet high!" On the other hand, it has been estimated by an eminent geologist that the Ganges carries down eight times as much silt as the Mississppi. The Ganges then carries 6,500,000,000,000 lb. of soil annually into the Bay of Bengal. A similar calculation of all the rivers of India will give one an idea of the huge erosion taking place in the soils of India. This loss of India's soil by erosion is complete and final. No replacement of it by mechanical or economical means is known. This loss of soil is progressive; and, unless means are adopted vigorously, India will soon lose her national asset, and the land that is now culturable will be soon classed as non-culturable waste.

Run-off.—The percentage of the water falling on the soil which is not absorbed by the soil, but runs off in the form of storm-water, is high, particularly when the ground is saturated in the locality where the rain occurs. In some regions it may amount to as much as 50 per cent of the rainfall. The amount of run-off depends on the following factors:—

(1) the distribution and amount of rainfall. In India there are very heavy downpours of rain in a short period of time which does the greatest damage. More gentle and evenly-distributed rainfall would have resulted in less loss by erosion;

(2) the slope of the land;

(3) the character of the soil, *i.e.*, where the soil is ploughed, has a porous or tight texture, and where the soil has an impervious layer below it;

(4) the nature of the vegetation covering the land; and

(5) where the soil is saturated with water or not.

The amount of run-off would be greatly reduced by altering the physical condition of the soil so as to enable it to retain as much rain-water as possible. Good tillage, deep ploughing, addition of farm-yard manure, the plough under of green crops would thus help to retain the rain-water and so to reduce run-off. The provision of bunds is also an effective way of preventing run-off. A minute study of run-off water will show that most of our soils in moderate rainfall areas lose from ¼ inch to ½ inches of soil annually from cultivated land.

This loss is greater in the hill district of Assam where the rainfall is much more.

Effects of Vegetation.—It is evident from the preceding paragraphs that erosion is a danger which must be dealt with rapidly and effectively unless one is content to allow the country to develop into an arid waste in a very short time. The encouragement of the growth of vegetation will effect a very great deal in preventing erosion and in helping to reclaim eroded areas. Vegetation reduces evaporation by diminishing the wind action and by shading the soil. A good vegetal covering also helps considerably in binding the soil particles together; one may frequently observe the effect which a single plant-root has in reducing the rate of growth of a small gully. Walking along any washed-out depression in the field manifests this clearly. Another beneficial result from a good cover of vegetation is the increase in moisture in the soil, and, later, the increase supply of underground water which is the outcome of this. This is effected in two ways: First, there will be a luxuriant root growth as each root affords a path down which the water can find its entry; and, secondly, the vegetation itself checks the flow of water, and thus increases the time of contract between the soil and the water flow over it, thus enabling a greater amount of water to be absorbed.

The run-off from heavily-grassed areas is always far less than from unprotected earth across which water rushes with uncontrolled force. In India the number of eroded acres of land has increased considerably due to the destruction of a number of forests.

Part 2

Protection of Cultivated Land.—Having stated briefly how erosion takes place and what effect it has, it remains to be explained how it may be prevented and what measures must be adopted to reclaim eroded land. In the first place, it will be advisable to consider the land which the farmer holds, is cultivated, and cropped annually.

In order to prevent erosion or denudation of cultivated lands, it is absolutely essential that money be spent on the necessary works. Mention of expense, it is feared, will harden the hearts of many farmers, but a study of the economic side of the matter should relieve their minds of the idea that it is anything but an economic business investment. The "Contour Ridging" of cultivated land entails a relatively small expenditure which is not high for anti-erosion works; and the increased yield from lands suitably protected will pay for this expenditure in a very short time and the value of the land will be considerably increased. Money spent on anti-erosion work is money invested wisely.

It must be borne in mind that, the greater the value of water flowing over the land and the greater the concentration of the flow, the greater will be the erosion.

The results of unchecked erosion are—

(1) the formation of channels through the land, commencing as small wash-outs and later developing into unsightly gullies, with the consequent disappearance of the soil;

(2) disappearance of the humus in the soil and continual appearance of fresh subsoil on the surface of the land; and

(3) the leaching out and washing away from the soil of chemical salts necessary for the successful propagation of crops.

The subsoil never has time to gain the properties needful for the growing of crops as it annually disappears and a lower stratum of earth is exposed.

These results may all be classed together thus:—

The inability of the soil to produce crops and the resulting depreciation of the value of land. This immediately raises the question of protection against soil washing or denudation.

The problem to be solved may be divided into two heads:—

(1) prevention of large volumes of rain-water from passing over the land causing what is called sheet erosion; and

(2) prevention of an accelerated run-off due to slope of land and increasing volume of water.

Rain-water Drains.—Before measures can be adopted to prevent the denudation or washing off of the soil on cultivated lands by the water falling on the lands themselves steps must be taken to prevent the access on the land of rain-water from outside areas. The only effective method of doing this is by the construction of rain-water drains of adequate size at the heads and sides of all the lands. The fault to be found with most farmers is that they almost invariably underestimate the intensity of run-off of rain-water after rain. A rainfall of say 2 inches in $1\frac{1}{2}$ hours, which is not an exception in the humid districts of India, can produce a run-off of 1,900 gallons per second per square mile very easily. Therefore rain-water drains capable of dealing with this amount of water are necessary where the rainfall is such, but in areas like; Assam, Bengal, Burma, and Madras, where the rainfall is more than this amount rain-water drains capable of carrying the whole run-off should be made because the construction of a drain which will not carry off the normal run-off is wasted labour, time,

and money. The consequences are disastrous to the lands which the drains were originally intended to protect. An overflow takes place, the drain bursts, a large volume of water concentrated into one stream pours down the land, and a gully is formed immediately which it is extremely difficult to prevent from growing in size.

Natural Water Courses. -In order to reduce the strain on artificial rain-water drains, natural courses of water should be made use of to a greater extent. These should not be ploughed up, and natural vegetation should be left undisturbed. The natural watercourse does not erode to any noticeable extent if the volume of water passed down it does not exceed that which is carried off under natural conditions. This is the limiting factor for the use of natural watercourses unless additional artificial protection is resorted to.

The cheapest and easiest method of constructing rain-water drains is to first roughly plough them out, using as heavy a plough as possible, and then to finish off the work with hand labour. The most suitable grade for rain-water drains is 1 in 300 or 1 in 400, depending on the type of soil on which they are constructed. In very rocky ground it might safely be increased to 1 in 100.

It is a good practice to plant the side of the drain with protective vegetation which will bind the earth and prevent it from being washed away. A suitable growth is "dub" Cynodon doctylon which in time mats closely with the earth.

Contour Ridges.—Undoubtedly the most efficient method of preventing washing of cultivated lands with any appreciable slope, having regard to cost, is by the construction of contour ridges.

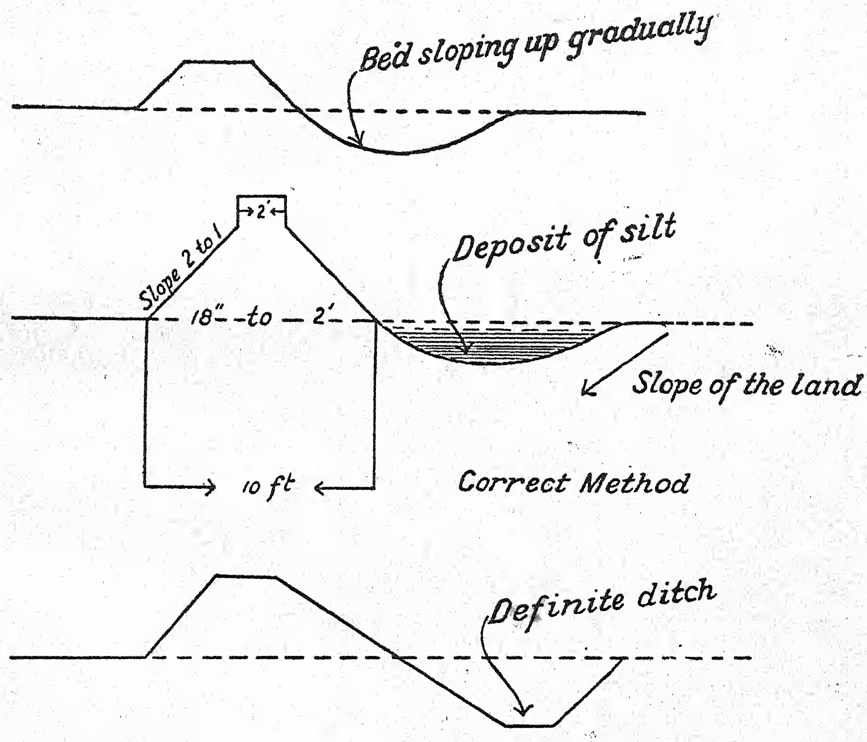
There are mainly two objects attained by contour ridging. The first object attained by contour ridging is the division of water flowing over the land into small controllable volumes, and the second object is the collection of silt behind the ridges.

Contour ridges may be briefly described as long, low mounds of earth running on a grade across the slope of land behind which the silt collects and the surplus rain-water drains off.

Lands Requiring Contour Ridging.—Almost without exception all land with a slope steeper than 1 in 40 will require contour ridging. In many parts of the country farming operations are carried on lands with an average slope of 1 in 20 to 1 in 30, and erosion is taking place in these areas to a marked extent. Soil washing and its loss may not be apparent to the casual observer, but to the experienced person the results of the evil are easily noticeable. Instances are common of the drop in crop yield, actually due to erosion being placed at the door of insufficient fertilization and other causes. It must be borne in mind that improve-

ment of soils by means of artificial fertilizers, green manuring, and other methods can never prove successful as long as water is permitted to wash the surface soil from cultivated lands.

Ridges.—A cross-section of a contour ridge is shown below. Contour ridges should be constructed with a final height of 18 inches to 2 feet, a top width of 2 feet, and a base width of about 10 feet. A base width of 8 feet may be employed for ridges 18 inches high, but the broader-based construction is without doubt more efficient.



Correct Method

Incorrect Method

Grade.—From general practical experience it has been found on a number of places that the most suitable grades on which to place contour ridges is 1 in 300 or 1 in 400. On land which is capable of heavy absorption of water the flatter grade may be used, but on land which will not absorb much moisture the grade 1 in 300 should be employed.

Distances Apart.—The distances between successive ridges is a very important point to be considered, and under no circum-

tances should they be set further apart than 100 yards. On steeply-sloping lands the ridges must be placed nearer to each other than this. The following table from Haviland may be used as a general guide:—

Slope of Land	Distance between Successive Ridges
1 in 40	100 yards
1 in 30	75 ,,
1 in 20	50 ,,
1 in 15	35 ,,

Length of Ridges.—It is essential, for satisfactory operation and to reduce the possibility of bursts occurring, that no ridge should be longer than 1,500 feet if discharge is to take place at one end only. A ridge of a total length of 3,000 feet can be constructed and work carried on satisfactorily if discharge takes place in both directions.

As a general rule, the longer the ridge, the shorter must be the distance between ridges. It must also be remembered in this connection that the length of a ridge is also dependent upon the type and state of the soil, which has a direct influence on the amount of run-off occurring after rain. The less the absorbing power of the soil, the shorter the ridges will have to be.

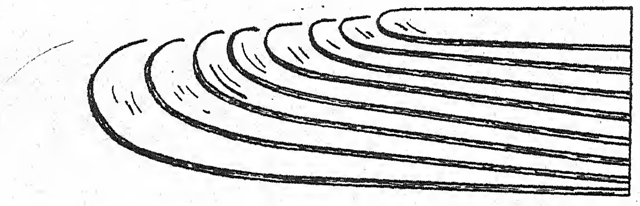
Crops on Ridges.—It is advisable to utilize the ridges. Almost any crop can be planted on the contour ridges. For the majority of the farmers it will be preferable to plant a crop on the ridge similar to that growing between the ridges. It is not desirable to plough the ridges at any time.

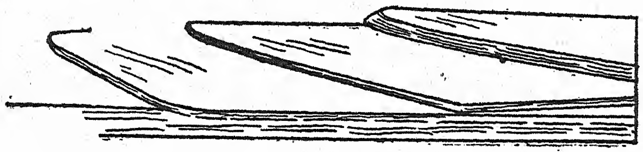
Napier fodder and sweet potatoes are suitable crops for ridges. These crops bind the ridges; and, if Napier fodder is planted, it will act as a wind-break.

Discharge from Contour Ridges.—The discharge from the contour ridges may be effected into artificial rain-water drains or natural watercourses. A natural watercourse for this purpose is more satisfactory, but it must be remembered that a natural watercourse must not be overloaded beyond its natural carrying capacity by discharging contour ridges and storm drains into it unless precautions are adopted to prevent erosion in the bed and along the sides.

Terracing.—Terracing is another most effective method of preventing soil washing. It consists primarily in reducing the slope over which the water moves, or in stopping the flow of water down the slope by breaks which gradually rise into banks separated by belts of plough land.

There are two distinct types of terraces—the bench terrace and the ridge terrace. A field of bench terraces resembles a series of benches, while ridge terraces are simply ridges of earth thrown up across the slope of the field.





Gullies and Wash-outs.—Having described a few methods of preventing soil erosion, it remains a task with us to devise means in stopping gullies and washes and in reclaiming eroded lands. In this connection, it is necessary to make use of all methods employed in preventing erosion. Aside from these, there are many other methods employed in stopping the advance of ditches and water-courses and in filling gullies.

Most frequently lands which cannot be used for farming because of excessive erosion must be reforested in order to be reclaimed. Trees should be planted thickly in the mouths of, and as far up, the gullies as possible.

A small wash-out can be silted up by placing a row of timber or bamboo stakes across. These must be well driven into the ground. Light branches, debris, straw, and dirt are then intertwined through the stakes and the silt is held up behind these barriers. This method is not very expensive, but efficient.

Another method of silting up gullies is to excavate a trench first across the gully-bed to a depth of 9 inches to 1 foot. Wire-netting is then laid in this trench and stones well packed in it. Usually, such a dam will gradually allow the gully to fill with sediment.

Brush, logs, stumps, and stones are excellent materials to throw into gullies. Such material should be well anchored to prevent its being carried away. Many ditches have been completely filled in this manner.

For the reclamation of badly-gullied and eroded land the following example from the Allahabad Agricultural Institute Farm will be of much value:—

"When we took possession of this land in 1912, it was badly gullied and eroded, so much so that much of it had been classed unculturable. The lay of the land was carefully studied by the Institute staff. Bunds of earth-work, with pucca spilt ways, were put in at convenient places. In a few years very striking results were evident. Along the actual river-bank, which was deeply gullied, the mouth of every gully had been closed by an earth dam. The earth was taken from the river-side. The river was in high flood in 1916. The result was that, when the river went down, behind these bunds we had beautiful level fields. Some of the gullies, by actual measurement 17 feet deep and 60 to 70 yards wide, were completely filled with beautiful rich soil. Opposite the big brick arch of the East Indian Railway a masonry dam was erected. In three or four years beautiful rich silt was collected, about 8 feet at the deepest, varying in width from a few yards to 60 or 70 yards, and extending back nearly half a mile. At the south boundary of the farm there was one place where three streams came into one big nulla. Advantage was taken of two promontories of stiff black soil. A masonry dam, costing a thousand rupees, was put in. Within five years there was a fill of 14 feet of rich silt. This dam reclaimed nearly seven acres for the Agricultural Institute, and well over forty acres for our village neighbours. The land which h d been the poorest in the village is now the richest."*

In conclusion, it can be said that prevention is better than cure. Every farmer should do a little anti-erosion work every year and adhere to a definite programme. It has taken many thousands of years to produce this rich alluvial soil of India, and the soil filched by uncontrollable erosion can never be replaced in a man's lifetime.

Testing the production of our cows one day every two months is a short-cut method that has proved successful; note the same in case your herd is too small for daily testing.

* * * *

It is estimated that in Great Britain and Ireland each year a million unwanted calves are born.

* * * *

Two weeks may be considered a time-limit for holding hatching eggs in low temperature.

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*Dr. Higginbottom—*The Allahabad Farmer.*

TRIALS OF BARLEY NO. 251

(In Pukhrayan, District Cawnpore)

By Narain Sinha Mathur

Barley No. 251 is a selection made by the Assistant Economic Botanist to Government, United Provinces. It is a new variety of better quality and is a heavier yielder than desi barley. Its grain has been examined by experts in England, as well as in India; and, as encouraging reports have been received, I desired to introduce it in Pukhrayan Sub-centre. To see if this variety would suit this locality the matter was referred to Mr. T. R. Low, Deputy Director of Agriculture, Cawnpore, and through him a few maunds of seed were received in 1928 and distributed amongst a few cultivators, who tried it in their fields. It was reported to have yielded better than desi barley, and the produce varied from 15 to 25 maunds seed per acre according to the soil fertility and irrigation facilities. Those who watched its progress from sowing to harvesting-time were very well impressed and requested the Superintendent of Agriculture to keep a stock of this variety in the Government Seed Depot for distribution. To meet the demand of the public all the produce of this barley was purchased from the cultivators who had grown it in 1928. Since then, it is being issued every year from the Pukhrayan Seed Depot. Its area is increasing and the produce is always reported to be better than the local barley.

To make the assurance doubly sure, and to demonstrate it to the public, the Superintendent tried it in the Government demonstration plot in the Rabi season 1931-32. The results are noted below.

The demonstration plot has no irrigation, and has not been manured for many years. It had a crop of gram in the Rabi season 1930-31. After the Rabi harvest the first ploughing was done on the 19th August, 1931, by a soil-turning plough, followed by a second ploughing on the 17th September, and a third on the 11th October, 1931. With these three ploughings with soil-turning ploughs the field was quite ready for sowing, but the three-inches of rainfall on the 16th October spoiled the tilth; hence it had to be ploughed up again on the 27th October, and barley No. 251 was sown on the 30th October, 1931, in an area of 1.95 acres, including a small corner in which sowing of gram P·25 was demonstrated. Rape-seed was sown in the borders in Pachkund (five rows). The total expenditure incurred on this plot was Rs. 41-8-9 only, per the following details:—

Ploughing 4 Times, Rs. 20. Sowing, Rs. 2, Cost of Seed Rs. 4-0-9
Harvesting Charges, Rs. 6-8. Threshing and Winnowing Charges, Rs. 9

The germination and growth in the first two months were satisfactory; but, as the winter rains failed, the crop suffered for

want of water in its later stages; hence the produce is far below expectations.

The receipts are noted below:—

	Md.	sr.	ch.				Rs.	a.	p.
Barley-seed	32	7	0	Sold at 22	seers per rupee		58	8	0
Gram-seed	6	7	0	„ 20	seers	„	12	5	6
Oil-seed	2	10	0	„ 12½	seers	„	7	2	9
Bhusa	47	22	0	„ 2¼	maunds	„	20	14	6
					Total Rs.	..	98	14	9

Thus the net profit from a 1·95-acres plot not manured and without irrigation is Rs. 57·6 in a season when the Rabi crops, chiefly wheat and barley, suffered badly in this locality.

Two things which this trial forcibly brings to the mind are the fact that a few timely ploughings by a soil-turning plough are better than double the number of ploughings by the desi plough, which is mostly used by the cultivators. The desi plough is more of a harrow than a plough. As it only stirs the soil without inverting it, the weathering agencies cannot play their full part in changing the dormant plant-food into available form. The main object of ploughing is to expose the soil to heat and light, which is not served by stirring the soil with the desi plough. It is therefore a false satisfaction to a cultivator that he ploughed up his wheat-field about a dozen times, and is a great waste of time, money, and energy when he uses the desi plough. More area can be commanded efficiently and economically by a pair of bullocks if the desi plough is replaced by a soil-turning one for ploughings during the hot and rainy seasons. Three deep ploughings with soil inversion given at the right time—one on the first rainfall, a second in August when the fields are very weedy, and a third in September, followed by the desi plough, will make a suitable seed-bed for a wheat crop, and the physical, chemical, and biological conditions of the soil will be highly improved, and the tilth and soil fertility will be better than that produced by the desi plough.

The second lesson that can be taken from the trial is the confirmation of the established truth that superior seeds yield better even in an unfavourable season. Reports received from the cultivators show that even the manured and irrigated fields of local barley have not yielded more than 15 maunds seed per acre this year, while barley No. 251 has given better outturns in all circumstances.

Agriculture is still as ever a profitable profession in India, provided it is run on improved lines which are both efficient and economical and suit the present conditions better. Bad seed, old methods, ignorance, and the conservative nature of cultivators in general are responsible for the low outturns of the day.

HORTICULTURAL NOTES

Fruit Preservation

By A. D. Chand, F.Ag., J.A.V.

Since ultility is an important factor in increased production, our Horticultural Department too, apart from raising and growing fruit trees, pays special attention to the devising of suitable methods of utilizing various fruits under local conditions. Thus these efforts of ours tend not only to encourage the producers of fruit, but also to guide them, as well as others, in starting cottage industries. The present general situation of India affords ample opportunities for the development of such industries which may go a long way in helping to solve the acute problem of unemployment.

Kumquat Preserve

Kumquat is commonly known by the name of "Hazara" or "Small China Orange" in India. At present, it is mostly grown as an ornamental plant, thickly laden with its small-sized fruit, rather than for human consumption, although in many localities its fruit is used for making kumquat pickle and marmalade. Since similar products can be more economically made from other fruits in this country, kumquat has not so far found any very important place in Indian horticulture. But there appears to be large scope for finding other uses for kumquat which may encourage and induce fruit-growers to pay greater attention to the culture of this fruit; and, as a natural development of the research in progress, it is expected that in time to come, this fruit may also be grown on as large a scale as other citrus fruits.

Process—For 200 Kumquats

One new use for kumquat is the preparation of kumquat preserve, which is herein explained, after successful trials in the Horticulture Section. The product has been held in high esteem by the public. The method of preserving is therefore presented to the readers of *The Allahabad Farmer.* The kumquats should be plucked when fully matured (deep orange-coloured), and with a small length of the stalk attached to them. This will prevent the fruits from bursting during the process, which should be avoided. Scrape the rind slightly and prick the skin all over with a wooden needle or prick. Put the fruits in a basin of cold water, and change the water every six hours for two days. On the third day bring a sufficient quantity of water to boiling-point; put the kumquats carefully in, and boil them for about 20 minutes. Remove the cooking vessel from the fire, lift the fruits gently

out of the boiling water, and put them straightway into a basin of cold water, which will make them firm. When they have been in the cold water for about four hours, put them gently in a brass wire sieve and let them drain properly.

Meanwhile, make a syrup, not too thick, of three seers of sugar and three seers of water. Put the boiled kumquats in a glass jar (a glazed earthen jar, or even an unglazed earthen vessel previously well soaked with water would do), and, when the syrup is cool, pour it over them. Some sort of weight (*e.g.*, a wooden board) should also be put in to keep the kumquats submerged in the syrup. After 24 hours draw off the syrup, thicken it over the fire, and, when cool, pour it again over the fruits and let it stand for two days. On the third day repeat the same process, and then let it stand for four days more. On the fifth day drain off the syrup, add a seer of sugar, and make it into a thick syrup, which, when cool, should be poured over the fruits, as before. This time keep the fruits in the syrup well immersed for ten days and on the eleventh day drain it off and thicken the syrup to the consistency of honey. This syrup, while still tepid, should be poured over the kumquats. Keep the lid off the jar until quite cold, and the preserve will then be ready for use after a couple of days.

Papaya Sweet Pickle

Recipe.—	Papaya Slices	5	lb.
	Sugar	3½	,,
	Vinegar	1½	,,
	Water	2	,,
	Black Pepper	4	Teaspoonfuls.
	Cloves	2	,,
	Cinnamon	6	,,
	Ginger	2	,,
	Red Chillies	2	(Not powdered)
	Bay Leaves	6	,,

Process.—Take green papayas only and cut into thin slices for the sake of convenience in peeling. Peel off the green skin and also remove the fibrous portion from the inner side of the pulp. Cut the slices into lengths of an inch or so and a thickness of about one-eighth of an inch and soak them in strong salt-water for about 24 hours. Apply a weight, preferably a flat piece of wood, to keep the slices immersed in the brine. Draw off the brine and cook the slices in fresh water for about half an hour or

(*Continued on page* 152)

THE "WAH-WAH" PLOUGH

By Mason Waugh

More than ten years' study of the equipment needs of the Indian farmer convinced the Agricultural Engineering Department of the Allahabad Agricultural Institute that none of the various improved ploughs which had been introduced in India fully met the needs of the ordinary cultivator. Each had some defect which hindered its wide adoption.

The ordinary wooden plough has the merit of being used for a variety of operations. To some extent at least it combines the functions of plough and harrow in the preparation of a seed-bed. With a bamboo spout attached, it is used for sowing certain crops which cannot be broadcast. Under favourable weather conditions it is used for the interculture of the monsoon crop. While it is true that it combines all these uses, it does so at a fearful cost in efficiency. It does none of the operations either well or rapidly or efficiently. It is comparatively cheap in first cost, but its short life makes it costly to use. It requires only a small amount of power to pull it, but it does so little work that its use severely limits the area which can be cultivated by one man and a pair of bullocks.

The need for a more efficient unit has long been recognized. The mould-board plough is so universally used in Western countries that the natural reaction was to introduce it here. Since larger animals, usually horses, are used there, it was necessary to introduce the smallest only here. Even they were rather large and heavy for the very small bullocks in common use, so attempts have been made to introduce even smaller models made especially for India. When made of good material and with decent workmanship, these have proved useful for certain conditions, but the insistent demand for something cheap has led to the manufacture of such ploughs from very poor material and with such poor workmanship as to be almost useless. The sale of such ploughs has been definitely harmful in that a farmer who has an unfortunate experience with such a plough will be even more prejudiced than before against any improved plough.

The mould-board plough inverting the soil was developed for humid climates where moisture conservation at the time of seed-bed preparation is rarely a problem. In the countries where it was first used there is usually some organic matter, weeds, stubbles, and manure, on the ground at ploughing-time. The common weeds and grasses are most easily killed by burying them under the soil. For a large part of the crop year opposite conditions prevail in India. The winter crop is seeded a month or more after the end of the rains, during which time the soil must be

worked several times to kill weeds and to preserve a mulch to conserve moisture. Many crops are grown to maturity without any more rain, and irrigation water, when available, is usually deficient in quantity, making the conservation of moisture a real problem. On well-cared-for fields there is usually no very heavy growth of weeds, and any manure that may be applied is usually composted first and easily incorporated into the soil. The weed most likely to be present is dubh grass, the stems of which sprout roots, and the roots develop leaves when it is ploughed up, making it reversible and very difficult to kill by ploughing under. While inverting the soil once after the rains was helpful, a seed-bed could not be prepared by this alone; and further ploughing results in excessive loss of moisture. The spring-tooth harrow helped in the preparation of a good seed-bed, but its high cost makes it difficult to introduce among poor farmers. The mould-board plough is definitely superior to the desi plough for preparing the monsoon crop seed-bed, but cannot be used for the interculture of crops or for seeding.

All these considerations make it essential that there be more than one type of implement to get the best results. To provide completely separate implements of several kinds means a very definite increase in the investment in implements which the ordinary farmer does not consider himself able to make. It seemed that a plough stock consisting of beam and handle to which various implements could be attached in some simple manner would best meet the need, providing the possibility of a variety of implements with the minimum expenditure. Work along these lines has resulted in the development of the "Wah-Wah" plough.

One of the important units seemed to be a mould-board plough with which the soil could be inverted and manure incorporated at appropriate seasons. Since the Meston plough is widely known and used among the improved ploughs, and the shares can be had more easily than others, a modified Meston bottom has been developed, the modification coming in the frog to adapt it to being bolted easily to the stock with three bolts. The stock is made of steel and shaped to more nearly the shape of the wooden plough and the beam is attached differently so as to allow more clearance under it. This additional clearance lessens the clogging of the plough in heavy weeds, grass, or green-manure crops. The beam is of wood, and resembles the ordinary wooden plough beam.

For conditions where only stirring of the soil is wanted, with mulching and the killing of weed without inversion, a share known in Western countries as a flat sweep is used. Its work resembles that of the Indian "bakhar," widely used in the cotton-growing regions of Central India. It is essentially a thin steel blade which can be worked under the ground at varying depths. It lifts and

breaks up the soil, but allows it to drop back into nearly the same position without much exposure of the moist soil underneath. If kept properly sharp, it will cut grass roots and weeds, killing them more effectively in many cases than ploughing would. It is especially successful with dubh grass, which it cuts off in such a way that it can be dragged to the surface with a harrow and removed from the field. The sweeps can be had in varying sizes. For ordinary small bullocks and fairly clean land a sweep 10 inches to 12 inches wide can be used. For very small animals and hard ground or land infested heavily with grass a smaller size can be used. With even an 8-inch sweep, the rate of working is much faster than the wooden plough, and the work done is much more thorough, enabling a suitable seed-bed to be prepared with fewer ploughings. The sweep can be used for interculture of row crops in practically the same way that the bakhar is used and for the same purposes.

It is also possible to replace these attachments with a furrow-maker for the preparation of furrows for irrigation, for sugar-cane planting, planting and cultivating of potatoes, and other purposes where a furrow is to be prepared in comparatively soft soil. Since making a furrow also results in making a ridge, it can be used for hilling up crops and for preparing ridges for crops planted on ridges or beds. The most useful all-round size of furrow-maker is about 12 inches across, but larger and smaller sizes can be used. The smaller size of furrow-maker, combined with a bamboo spout, allows the plough to be used for planting in the same way as the wooden plough.

Doubtless, additional attachments will be devised as the need becomes apparent. In the meantime, these three seem to fairly well meet the need of the small farmer. With this plough and a wooden planker or drag such as is ordinarily used the farmer can perform all the operations he has been accustomed to do with the wooden plough and planker, and do them much more efficiently and quickly.

Manufacturing arrangements have not yet been fully completed, but limited numbers can now be supplied. Prices and full details can be had from the Agricultural Engineer, Allahabad Agricultural Institute.

Experiments have shown that the afternoon rest of children is much quieter then their night rest.

* * * *

"Increase profits by reducing costs. Reduce costs by eliminating inefficient animals and by better feeding and care."

* * * *

Over 500,000 pounds of cheese were imported into India in 1930.

ESTABLISHING AN ORCHARD

By W. B. Hayes, M.Sc.

When an intelligent young man, even with an agricultural college training, takes up fruit-growing on modern lines, he is faced with many practical problems. The better his training, and the wider his acquaintance with fruit-growing, the more successful is he likely to be in solving these problems. However, there are still questions in Indian horticulture to which the answers are not known. There is need for much experimental work, such as has been, and is being, carried on in other countries. Meantime, the fruit-grower can, by using such knowledge as is available, avoid the more common pitfalls.

One of the first questions which arises is that of which varieties to plant. The kind or kinds of fruit will be determined largely by the climate, and by the demand of the local market. It is generally wise to grow several kinds, thus distributing labour and decreasing the chances of total failure in any year. On the other hand, it is desirable to have a fairly large block of each variety. Varieties should be chosen so that not more than one or two will be ripening at one time. If good early and late varieties are available, an orchard should be planned to mature fruit throughout the season.

It is seldom wise to plant seedling trees. These have little to recommend them except their low initial cost. In the case of most fruits, it is possible to secure uniform fruit of high quality only by using trees propagated by vegetative means. Such trees, if well grown, are as strong and healthy as seedlings, and produce fruit of much greater value. Many methods of vegetative propagation are used, all of which are satisfactory if they produce vigorous trees. Cuttings, layering, and gootee are simple methods, but are applicable to few fruits. The branches and roots are of the same plant. The other methods, budding and grafting, depend on uniting a branch or part of a branch of a good tree with the root of another, generally a seedling grown for the purpose. Most fruits can be budded; and this is probably the best method of commercial propagation.

Most growers will have to depend on commercial nurseries for their plants when starting. Later on, they may expand by growing their own, a plan which can be used to advantage even at first by those with skill in the process and who make their plans several years ahead. In buying plants, one should be particular to deal only with reputable firms. It is very easy for a nurseryman to sell inferior varieties and have his dishonesty found out only after a number of years. One can judge the physical condition of trees, but must depend on the nurseryman's word as to the variety and quality. This difficulty is especially great in India where there is much confusion in nomenclature.

Whether growing plants, or buying them, one should consider both the stock, or root-bearing portion, and the scion, which forms the trunk and branches. The stock has comparatively little influence on the fruit, except as it makes for a vigorous or weakly tree, but this, of course, is a vital point. The scion determines the type of fruit, and should come from a tree of known high production of the best quality of fruit. It is also important that stock and scion should suit each other, which can be discovered only by experiment and by observing the practice of the region. The stock does not need to be of the same species as the scion: often the best results are obtained with different species. Oranges, for instance, are often grown on stocks of other citrus species.

The most common mistake made in planting orchards in this country is that of crowding the trees. During the first few years this produces more fruit; but, as the trees approach maturity and the trees interfere with each other, both quantity and quality suffer. In a mature orchard not more than an occasional branch should touch a neighbouring tree. To estimate the space needed, measure the spread of a mature tree growing alone under similar conditions of soil and climate, and use that figure as the distance between trees. This will mean, under most conditions, that such trees as oranges and guavas will be placed at least 25 feet apart, while mangoes will be 45, or even 60. While the trees are young, the space between them may be occupied by rapidly-growing fruit trees or by other crops, but these should be removed before they interfere with the permanent trees.

It would seem obvious that trees should be planted in straight rows, yet many Indian gardens look as if the seed had been broadcast. More likely, many of the trees have grown where some bird dropped the seed. The trees may well be planted either in squares or in equilateral triangles. The latter system has the advantage of allowing for 15 per cent more trees per acre than will be accommodated by the square system, using the same distance between plants. It allows cultivation in three directions, instead of two.

Much has been written as to the desirability of digging holes several months before planting, and making them very large. Four feet in diameter and four feet deep is sometimes advocated. This involves much labour, and is of very questionable value, at least where the soil is in fair condition. It is desirable to dig the hole somewhat larger than is necessary to receive the plant. In setting the plant, place it so that the soil will come as far up on the stem as it did in the nursery. A very common mistake is to put the plant in a pit to facilitate irrigation. This often results in the earth coming too high up on the trunk, or in water collecting around the plant during the rains and killing the plant.

RURAL UPLIFT WORK IN ALLAHABAD DISTRICT

THE ALLAHABAD AGRICULTURAL ASSOCIATION

The Allahabad Agricultural Association, for facility of rural uplift work in Allahabad District, proposes to hold two training classes in the two tehsils of Allahabad District, namely, Manjhanpur and Chail Tehsils, as per scheme attached below. On account of a canal there are irrigation facilities in these two tehsils; therefore it has been decided first to hold training classes in these tehsils.

These teachers, on being trained, will be requested to help in the rural uplift work.

Scheme of the Two Proposed Training Classes of all the District Board and Hindu Sabha Pathshala Teachers in Do-aba (i.e., between the Two Rivers, the Ganges and the Jumna) in Manjhanpur and Chail Tehsil, District Allahabad.

(1) The training class will be held for a fortnight in Manjhanpur and Chail Tehsils in the month of June, 1933, when the schools are closed for the summer vacation.

(2) In Chail Tehsil the training class will be held in the Tehsil Middle School in Chail from the 1st to the 14th June, 1933.

(3) In Manjhanpur Tehsil the training class will be held in the Tehsil, Middle School, Karari, from the 16th to the 29th June, 1933.

(4) The Chairman, Education Committee, District Board, Allahabad, has kindly agreed to issue a circular to all the District Board Schools in the above two tehsils, making it compulsory for all the teachers to attend the two training classes.

(5) The Honorary Secretary, Hindu Sabha Pathshalas, will see that all the teachers of the Hindu Sabha Pathshalas attend these classes.

(6) Arrangements will be made for the free accommodation of these teachers and lecturers in the boarding-houses attached to the two tehsili middle schools named above.

(7) On account of scarcity of funds, it will not be possible to give any kind of allowance to the teachers.

(8) In the training class lectures will be delivered on the following:—

AGRICULTURE

(1) Practical agricultural training in the compound of the school or in some field close by daily from 7 to 11 a.m.; and

(2) 11 agricultural lectures will be given on the following from 6 to 8 p.m.:—

I. *Seed*—

(*a*) Sugarcane; (*b*) Wheat; (*c*) Paddy; (*d*) Linseed; and (*e*) General Knowledge.

II. *Cultivation*—

(*a*) Advantages of ploughing with soil inverting plough;
(*b*) Proper time of using Meston and Desi Ploughs; and
(*c*) Cultivation of sugar-cane—
   (*a*) In line on flat; and
   (*b*) In trenches;
   (*c*) Which method of cultivation of sugar-cane should be employed, and under what conditions;
   (*d*) Use of harrow and chaff-cutter; and
   (*e*) Cattle.

III. *Manuring*—

Prevention of cattle urine manure by two methods—

(1, Replacing the earth of the bullock stall after every two months; the earth of the bullock stall should always be kept open by weekly digging and stirring of earth up to a depth of 4 inches;
(2) The cattle urine can also be preserved by spreading leaves and weeds under cattle and removing it every day to the manure-pit;
(3) Proper method of storing cow-dung manure—
   It should be preserved in pits protected from sun and rain and from water flowing into the manure-pit;
(4) Proper method and time of applying cow-dung manure;
(5) Extension of green manure; and
(6) Utility of oil-cake manure.

IV. *Irrigation*—

Demonstration of water-lifts.

V. One lecture will be delivered in each of the following subjects also:—

(*i*) Veterinary;
(*ii*) Co-operative; and
(*iii*) Sanitation and hygiene.

I beg to append below a list of the various zamindars of the Allahabad District who, so far, have been approached by the Association with a request to open demonstration plots on a small scale in their respective zamindaries for the encouragement of poor

cultivators residing in the surrounding localities. These zamindars have given their consent to the above.

Other zamindars will also shortly be approached by us about this matter:—

(1) Babu Dwarka Prasad Johari, in Village Awana Alampur, in Tehsil Manjhanpur (Canal Area);

(2) Babu Rikhal Das, in Village Jathi, Tehsil Manjhanpur (Canal Area);

(3) Mahant Dharma Das, of Punchayti Akhara, in Village Tehsil Chail (Canal Area;)

(4) Thakur Sheo Krishna Sheo Pratap Singh, B.A. LL.B., in Village Tilhapur, Tehsil Chail (Canal Area);

(5) Rai Sahib Babu Amar Nath, of Bari Kothi, Daraganj, Allahabad, who has got his zamindaries in the following 5 tehsils of the Allahabad District: Phoolpur; Handia; Soraon; Meja; and Karchana. He is willing to start demonstration plots in all the above 5 tehsils according to the advice of the Agricultural Department after visiting the various sites;

(6) Thakur Deo Prayag Singh, of Sarai Akil (Tehsil Chail), which is the market-town of Tehsil Chail, who is willing to open a demonstration farm. There is no main canal in this area, but he is willing to have a Persian-wheel fixed in one of his wells;

(7) Thakur Raghunath Sahai, of Uno (P.O. and Tehsil Majhanpur), who is also willing to have a demonstration plot;

(8) Thakur Raghuraj Singh, of Seora, P.O. Purab Sharira, who is also willing to have a demonstration plot in his village; and

(9) Thakur Abhoyraj Singh Sahib, of Dhokari (Tehsil Handia).

(*Continued from page* 144)

so until the slices are transparent and soft. Remove them from the fire, drain off the water, and put the cooked slices in a glass jar. Add all the ingredients mentioned in the recipe (excepting the papaya slices) to the vinegar and two seers of water (although the quantity of water may vary according to the strength of the vinegar), and bring them all to a boil. Pour this mixture, boiling hot, over the cooked papaya slices, and let them all stand for a day at least before using.

Water-melon Sweet Pickle

The process of making water-melon pickle is exactly the same as for papaya, above mentioned, except that only the white portion of the pulp is used for pickling.

Note.—If more cloves than are given in the recipe are added, they will produce a dark colour in the pickle, in both cases, which is not desirable.

The Allahabad Farmer

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The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

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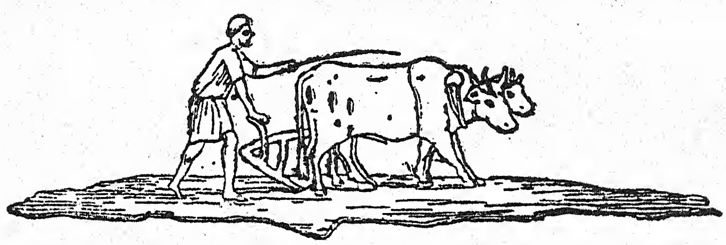

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ALLAHABAD FARMER

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EDITORIAL

The World Is Sick.

And almost anyone is willing to prescribe a remedy! One man tells us that the only way is the adoption of socialism, another prescribes communism, and another suggests technocracy as the way out.

We read our newspapers and talk glibly about world reconstruction, of social justice and economic security, on the public forum, in the market-place, and over a cup of tea.

The present is a period for examining the old order of things and a reaching out for a new way of life that will meet certain indispensable conditions.

One of the programmes suggested for this new world is *the adoption of the co-operative system of industry*, not necessarily as a final solution to our social and economic problems, but as a present corrective for disorder in these realms.

* * * * *

The Co-operative Movement.

This movement is by no means new, and has been in existence in organized form for nearly a century.

It is a movement which recognizes the need for educating citizens, whether of the farm or factory, for a better society. It is primarily interested in bringing about greater *economic justice*. It seeks to develop social-mindedness and deeper democratic experiences which we all fearfully lack.

The movement has grown from extremely meagre beginnings to a world-wide movement, which includes the sixty million members of the two hundred thousand co-operative societies of forty countries federated in the International Co-operative Alliance.

The co-operative movement is not a doctrinaire theory which was first formnlated and then applied. It started as a result of a crisis among a few neighbours for their own benefit. The theories came only after the plan had proved successful, and the philosophy of the movement evolved as a result of a practical doing. The pattern was developed without intention, growing out of the natural development of the attempt to apply an ideal.

In our September number we shall outline briefly the development of the co-operative movement in the country in which it started.

* * * *

The Relation of the Landowners, the Zemindars, to the Tenant Farmers.

One may search, without result, through the long report of the Royal Commission on Agriculture for the situation concerning the relationships of owner and tenant, of taxation, etc., yet this relationship presents one of the worst difficulties facing organized effort at rural betterment.

The subject has, however, not escaped the attention of our leading economists in India, and a special article on this problem, for *The Allahabad Farmer* readers, written by Professor C. D. Thompson, Head of the Department of Economics, University of Allahabad, will shortly appear in our columns.

* * * *

Rural Knowledge.

In 1930-31 the United Provinces Department of Education adopted a policy of training batches of rural teachers (of whom there are about 600 in the United Provinces) in "rural knowledge." In that year 60 teachers were sent to the Agricultural Institute for the necessary training. The course given was in the Hindi vernacular, and covered a full academic year of ten months.

The purpose of such a course is not to turn out "experts," but to implant certain fundamental *attitudes* in the mind of the teacher, which he, in turn, can transplant in the minds of the pupils under his charge in the rural school.

In our September number we will begin a series of articles setting forth the content of this course in all its phases.

* * * *

Milk as a Public Utility.

There are many illustrations to indicate that milk is the centre of a new and fast-growing movement to regard it wholly or partly as a public utility, and therefore a subject of public interest and municipal legislation.

We understand that the Delhi Municipality has been contemplating for some time some scheme of municipal milk control.

The chief reason why milk in general is of poor quality in our Indian cities lies in the fact *that price-cutting is rampant* amongst distributors.

In the West, price fixing of milk has been resorted to by public utility boards, milk marketing commissions, and municipal boards, etc., in order to improve the chaos that exists in the dairy industry.

Connecting dairying with politics cannot be regarded as a permanent solution, yet control there must be in order to place the industry on an organized basis.

What is your municipality doing with regard to supervising and regulating the milk industry—production, processing, distribution and sale?

* * * *

Relief for United Provinces Peasants.

We are glad to note that a bill which makes provision for the relief of agriculturists from indebtness has been introduced into the Legislative Council.

The object of the bill is to provide legal facilities by means of which agricultural debtors can get their accounts settled without recourse to lengthy and costly litigation.

The bill makes provision whereby an agriculturist debtor can apply to a civil court to get his account settled and to fix instalments for the payment of any sum due. It enables a debtor to deposit in court a sum of money in discharge of his debt for payment to the creditor; it limits the sale of agricultural produce in execution of decrees to four years; it compels creditors to maintain their accounts to enable debtors to receive statements of their accounts; it makes it a penal offence for a creditor to enter in his books a sum larger than that actually lent.

* * * *

The Bombay Butter Scandal.

The recent disclosures made by the *Times of India*, Bombay, into the existing demoralized conditions of the butter industry in the Bombay area are timely.

It is said that Bombay consumes about 18,000 lbs. of butter a day, and of this amount 9,000 lbs. is not pure butter at all, but butter adulterated with about 60 per cent of "edible fish oil."

While the situation lasts, Bombay is being mulcted at the rate of about Rs. 4,000 a day.

There is a clear need for increasing the powers of the health authorities so that they may be able to bring both manufacturers and retailers to book.

* * * *

The Message of Women to Women.

(A Condensed Statement of an Address by Mrs. Sam Higginbottom).

One of the outstanding results of education is the way that women of the cities, during the last few years, after giving up purdah themselves, have organized to acquaint their sisters in the villages with political matters, especially concerning the boycotting of foreign goods. But how are they to feel such responsibility that they will contribute towards higher ethical standards in village life; to break

down traditions that have caused disrepute and misery for the women of India?

How are we ever going to train women who even hold back the men that should be leaders in the villages?

The only way we shall ever teach village women is by our example at getting down to their level and by a definite effort to train and inspire them.

"As I have gone around in the villages, I know the first place to begin is in the court-yard of every woman's home. In each of these court-yards there is a cesspool of dirty water, drainage from dishes, bath, and cattle, breeding flies and mosquitoes and disease. That water could all be used in irrigating a little patch of vegetables, although it may only be a couple of square feet. That is where we have to start—in those court-yards. But in those court-yards live the home-makers of India. But we must not stay there. *We must press on to attack* other problems.

* * * *

In Japan.

"The Government and the community maintain organized services for the country people which, in the field of physical and biological guidance, compare favourably with those of any country. *But the poverty of the farmer makes it impossible for him to avail himself to the full of these opportunities.* Economic pressure is steadily getting more unbearable. With this the rural people are losing cultural, social, and spiritual advantages that ought to be increasingly theirs. There is, too, in all official service a lack of the spirit of personal interest and idealism. A new faith and a spirit of voluntary devotion are needed to make the Government *programme effective.*

* * * *

Education in Idleness.

To-day with unemployment, in the organized sense, rife in every direction, amongst both the illiterate and the intelligentsia folk, the question arises as to what constructive use can be made of leisure time.

With improvements in scientific resources, the industrial day has become shortened, and will doubtless become shorter as improvements are accepted by society. Even to-day some men have very much more leisure than is good for them, and some men have considerably less leisure than what might be good for them.

It is said that the most significant test of the education of a people is to be found in the way in which they spend their leisure.

How much of leisure time is not frittered away in boring idleness? Is purposeless idleness also not the most boring form of work, whereas is real work not the most enduring form of pleasure?

It is true that parents suffer just as much at the hands of idle children as children do at the hands of idle parents. Both should have an education as a means to a career and a livelihood, and as a means to good living and equipment for leisure.

I think our readers will agree that the ordinary schooling is a rigid routine of preparing for examinations, and that, as such, it smothers a great amount of original and creative ability.

The trend in education at the best schools, where they do try to find out their pupils' gifts and encourage them, is commendable, but it is not always so wholesome and profitable as to let children discover their own gifts and cultivate them.

Leisure school hours are ordinarily looked upon as a possible temptation and danger; but why should the student not be encouraged and trained to use his leisure time, without which so much of his leisure in later life will be spent in pure idleness?

Another aspect of idleness is that which concerns the village. Between the seasons there are periods of inactivity which you have all recognized. There seems to be an opportunity and a need for *organizing this leisure* for the establishment of subsidiary village industries, for the establishment of social centres where men and women may meet and talk and discuss and read and exchange thoughts and experiences!

* * * *

Rural Progress in India.*

The most notable contribution to rural progress in India during the last decade has been in the nation-wide recognition of the value and necessity of rural reconstruction. The Y.M.C.A. in the South, Tagore in Bengal, Mehta in the United Provinces, and Brayne in the Punjab were the leaders in this movement. K. T. Paul represented the evolution in rural thinking when he said, "The Indian villager is not helped unless he is helped simultaneously in every phase of his life; and, in regard to every relationship he bears to others, the service must be comprehensive to get anywhere. And it must be simultaneously comprehensive. In other words, what is wanted is not reform, but reconstruction from the centre, out and all round."

The validity of this reasoning was soon recognized, and one finds national organizations such as the Y.M.C.A., the National Christian Council, the Servants of India, and the Government of India, through its Provincial Co-operative Departments, making every effort to meet the larger needs of the rural community. Many of the co-operative societies sponsored by Government, which were formerly interested in credit, now have for

**The International Association of Agricultural Missions.*

their object the promotion of the economic, social, and educational interests of their members by means of a reorganization of community life in the villages, especially by improving agriculture and social conditions, and by teaching constructive recreation and hygiene.

The great handicap in the development of this work has been that of effective leadership. College-trained workers who had been directing rural bank and educational work were not equipped to meet the demands of this larger rural service. Short courses were then offered by the Y.M.C.A., mission agricultural schools, and Government agricultural colleges to enable these men to get supplementary training. Now all schools related to the training of leadership for the rural community are recognizing the necessity of having courses bearing on rural reconstruction.

—W. WISER.

* * * *

Women—India.

"India has, from one point of view, a certain richness of family life, with much background and many points of contact for the worker to discover and use. The colleges have trained some fine and capable young women, and many of them are doing excellent work; but, as has been said before on many occasions, most of the missionaries,—*foreign or native*—are town-minded; and India is pre-eminently a land of villages and rural life.

"There needs to be in the schools a far greater emphasis on understanding rural life, and special training for those who undertake to do rural work,—training for village school teachers and health workers, not to mention the wives of men teachers.

"The training which is most needed will include: Improved methods of teaching; more intimate knowledge of the social interests of rural homes; practical health education, which is lacking now to a surprising degree; and better technique in teaching. Training such as is given at Moga to men workers should be adapted to girls' schools and teaching centres."

—MRS. HARPER.

* * * *

Census Figures.

The 1931 census of the United Provinces reveals that the total population of British territory stood at 48,408,673, convering an area of 106,248 square miles.

The number returned as literate in any script is 2,309,358, of whom 218,290 were females. The number of persons literate in English is 268,936, of whom 26,113 are females.

Among Brahminic Hindus there is one literate person for 22 illiterate, and one literate woman for 146 illiterate.

Among Moslems one person is literate for 19 who are not, and one woman for 75 who are not.

The total number of unemployed men between the ages of 20 and 40 who can read and write English is 1,975.

The total number of beggars, vagabonds, etc., is 194,458.

The total number of cultivators is 19,419,218.

The density of population in British districts is 456 persons to the square mile. The density of the province as a whole, which had been reduced by the influenza epidemic from 440 persons to the square mile in 1911 to 427 in 1921, has risen to 442.

* * * *

Rinderpest

Each year this disease takes its toll of untold numbers of cattle in India. It is one of the diseases that makes cattle-breeding a risky proposition and acts as a great draw-back to the development of dairying as an industry in India.

It is a disease which the villager accepts with his usual stoic attitude without in any way endeavouring to do very much about it.

It has been found that even some of those people engaged in rural philanthropic work are at a loss as to what should be done when an outbreak takes place.

The suggestion is made that, when disease makes its appearance in your district, you should at once communicate with the District Veterinary Inspector or the Superintendent of the Civil Veterinary Department of your province. Through their auspices inoculations can be carried out that will give immunity to cattle against "rinderpest" and check an outbreak in its earlier stages.

The serum and virus for these inoculations are prepared by an expert staff at the Imperial Institute of Veterinary Research, at Muktesar (Kumaon), United Provinces. The price of the serum was reduced last March, and is now within the reach of cattle-owners having cattle worth protecting.

You can test your cows for tuberculosis by the tuberculin test. Consult your local officer of the Civil Veterinary Department.

The yard-stick of dairy herd improvement is herd recording. Sample forms can be secured from the Editor.

Poultry keeping in backwards is profitable!

A PRAYER FOR TEACHERS

By Glenn Frank

O Lord of Learning and of Learners, we are at best but blunderers in this godlike business of teaching.

Our shortcomings shame us for we are not alone in paying the penalty for them; they have a sorry immortality in the maimed minds of those whom we in our blundering mislead.

We have been content to be merchants of dead yesterday when we should have been guides into unborn to-morrows.

We have put conformity to old customs above curiosity about new ideas.

We have thought more about our subject than about our object.

We have been pedlars of petty accuracies when we should have been priests and prophets of abundant living.

We have regarded our schools as training camps for existing society to the exclusion of making them working models of an evolving society.

We have counted knowledge more precious than wisdom.

We have tried to teach our students what to think instead of how to think.

We have thought it our business to furnish the minds of our students when we should have been labouring to free their minds.

From these sins of sloth may we be freed.

May we realize that it is important to know the past only that we may live wisely in the present.

Help us to be more interested in stimulating the builders of modern cathedrals than in retailing to students the glories of ancient temples.

Give us to see that a student's memory should be a tool as well as a treasure chest.

Help us to say "do" oftener than we say don't."

May we so awaken interest that discipline will be less and less necessary.

Help us to realize that, in the deepest sense, we cannot teach anybody anything; that the best we can do is to help them to learn for themselves.

Save us from the blight of specialism; give us reverence for our materials that we may master the facts of our particular fields; but help us to see that all facts are dead until they are related to the rest of knowledge and to the rest of life.

May we know how to "relate the coal-scuttle to the universe."

May we be shepherds of the spirit as well as masters of the mind.

Give us, O Lord of Learners, a sense of the divinity of our undertaking.

[Taken from the January, 1933, *Educational Review*, the Quarterly of the China Christian Educational Association, Shanghai, China: With acknowledgment to the Agricultural Missions Foundation.]

PRACTICAL HINTS ON VEGETABLE CULTURE IN INDIA

By "Sherrard"

Part 4

The Tabular Statement Explained.—Is the tomato a vegetable or a fruit? This is a much-debated question. Botanically, it is a fruit. Nevertheless, we grow it in the vegetable garden, and for this reason I have included in the tabular statement all produce that are, as a rule, grown in the vegetable garden. Strawberries, melons, rozelles, Cape gooseberries, etc., have all found a place here. A wealth of information is given in this statement intended as a ready reference. By referring back to the preceding text, full details of the "method" of sowing, the "classes" of seeds, etc., will be found. In the next part of this article short cultural hints for each vegetable will be given; such information which is not in the tabular statement or the text preceding it will be found here.

Therefore, to use the tabular statement correctly, you must first refer to it for the information required regarding any particular vegetable, then consult the preceding text, to which the statement has referred, for the *general* information, or the information required *before* the seed is sown; and then consult the succeeding text for *detailed* information or the information required *after* the seed is sown.

The "time of sowing" covers the earliest and latest period during which seeds may be sown. The period midway between these dates is generally the best time for sowing when only one or two sowings are to be made.

H. = Hills. P. = Plains.

Seeds of most of the more important imported vegetables are obtainable in three "strains," namely, early, mid-season, and late. To obtain a good succession of vegetables, all three strains should be sown.

This does not mean that the first sowings must be made of the early strain and the last sowings of the late strain. On the contrary, all three strains may be sown together as soon as the season is favourable. The question is only one of time taken in development. With cauliflowers, for instance, some early strains are ready in three months, while the late strains take as long as six months to mature.

In private gardens the tendency is to neglect seed-sowing until the season is far advanced. When this occurs, only the very early or quick-maturing strains should be sown. For late sowings, quick-maturing varieties are absolutely essential.

Quite another question arises with acclimatized cauliflowers. There are three distinct strains, all of which take about the same time to mature; the succession in this case is, however, obtained by *successive* sowings of *different* strains. It is no use sowing the early strain of these seeds, late in the season, nor the late strain early in the season, because they would fail to develop. It is essential that the *right* strain be obtained and sown at the right time. The dealer's instructions should always be sought and carefully followed.

There is one golden rule which must be observed in all seed-sowing. *Never sow your entire supply in one sowing.* No matter how small the quantity of seed, sufficient should be retained to make a second, third, or even a fourth, sowing. These successive sowings, apart from proving whether the seed was good or bad, will give a succession of vegetables extending over a longer period than would be the case with only one sowing.

The "class" and "method" have both been fully dealt with in the preceding text.

The "distance" refers to the distance between two rows of plants and the distance between plant to plant in the same row. Under this heading two figures are given: the first refers to the distance required between the rows, and the second the distance required from plant to plant in the same row. In the case of seeds belonging to Class I, the distances are those at which the seedlings are planted.

Example: Cauliflowers $2\frac{1}{2}$ ft.—2 ft. means the rows are $2\frac{1}{2}$ feet apart and the plants are planted 2 feet apart in the rows.

In the case of seeds of Class II, the first figure denotes the distance between rows, and the second denotes the distance at which the seedlings will stand after their final THINNING OUT.

Example: Carrots 1 ft.—9 in. means the rows are a foot apart, and the final thinning out will leave the plants 9 in. apart in the rows.

For Method D, the first figure denotes the *clear space* from the edge of one trench to the edge of the next trench, and not the distance from a plant in one trench to the opposing plant in the next trench.

The figures for Method E represent the distance from centre to centre of pits.

The names of vegetables marked with an asterisk denote country vegetables or those so thoroughly acclimatized to reckon them as indigenous products.

The asterisk before the letter in the "method" column denotes that bulbs, cuttings, or stools are usually planted, instead of seeds.

English Name	Vernacular Name	Latin Name	Natural Order	Time of Sowing	Class	Method	Distances
Beans							
Bean, Broad ..	Bakla sem ..	Vicia faba	Leguminosae ..	P. Oct.-Nov.; H. Oct. & Mar.	II	D	2½ ft.-1 ft.
Bean, French, Kidney ..	Vilaiyti sem ..	Phaseolus vulgaris ..	„	P. Sep.-Nov.; H. Apr.-June ..	II	D	1½ ft.-1 ft.
Bean, Runner ..	„ ..	„ multiflorus ..	„	P. Sep.-Dec.; H. May-June ..	II	D	4 ft.-1 ft.
*Bean, Asparagus or Cuba	Lobia ..	Vigna catjang, Var. sinensis	„	P. May-Jan. (9 months) ..	II	D	5 ft.-1 ft.
*Bean, Sword ..	Bara sem ..	Canavalia ensiformis ..	„	P. May-July	II	D	6 ft.-2 ft.
*Bean, Country ..	Makhan sem (The best of several varieties) ..	Dolichos lablab ..	„	P. May-June; H. May-July	II	D	5 ft.-1 ft.
*Bean, Velvet ..	Uda sem ..	Mucuna capitata ..	„	P. May-June	II	D	5 ft.-1 ft.
*Bean, Goa ..	Charconi sem ..	Psophocarpus tetragonolobus	„	P. May-June	II	D	5 ft.-1 ft.
Gourds							
*Bitter Gourd, Hot Season	Karela ..	Momordica charantia ..	Cucurbitaceae ..	P. Feb.-Mar.; H. Apr.-June	II	D	5 ft.-1 ft.
*Bitter Gourd, Rainy „	Kareli ..	„ balsamina ..	„	P. June-July; H. Apr.-June	II	D	5 ft.-1 ft.
*Bottle Gourd ..	Lauki ..	Legenaria vulgaris ..	„	P. Feb.-Mar. and June ..	II	D	10 ft.-10 ft.
*Cucumber, Hot Season	Kakri ..	Cucumis sativus ..	„	P. Feb.-Apr.	II	E	4 ft.-4 ft.
* „ Rainy „ ..	Khira ..	Cucumis utilissima ..	„	P. May-June; H. Mar.-July	II	D	5 ft.-1 ft.

English Name	Vernacular Name	Latin Name	Natural Order	Time of Sowing	Class	Method	Distance
*Gherkin	Gol-Khira ..	Cucumis sativus, Var...	Cucurbitaceae	P. Feb.-Mar.	II	B	1 ft.-6 in.
*Marsh Melon ..	Kharbuza ..	Cucumis melo ..	"	P. Jan.-Mar.	II	E	15 ft.-15 ft.
*Pumpkin	Kaddu ..	Cucurbita moschata & C. pepo	"	P. Feb.-June; H. Mar.-June	II	E	10 ft.-10 ft.
*Squash Melon ..	Tendu ..	Citrulius vulgaris, Var. fistulosus ..	"	P. June-July	II	E	5 ft.-5 ft.
* ..	Palwal ..	Trichosanthes diocia ..	"	P. Mar.-July	II	*D	2 ft.-1 ft.
Squash, Vegetable Marrow ..	Vilaiyti Kumra	Cucurbita pepo ..	"	P. Feb.-Mar., June-July; H. Mar.-June ..	II	E	6 ft.-6 ft.
*Snap Melon ..	Phunt ..	Cucumis melo., Var. momordica ..	"	P. Feb.-Mar., June-July ..	II	E	5 ft.-5 ft.
*Spong Gourd, Ribbed..	Kali or Jinga tori	Luffa acutangula ..	"	P. Feb.-Mar., June-July ..	II	D	5 ft.-1 ft.
*Spong Gourd, Cylindrical	Ghiya tori ..	" aegyptiaca ..	"	P. Feb.-Mar., June-July ..	II	D	5 ft.-1 ft.
*Snake Gourd ..	Chichinda .	Trichosanthes anguina	"	P. Mar.-Apr.; June-July ..	II	D	5 ft.-1 ft.
*White Gourd ..	Petha ..	Benincasa cerifera ..	"	P. Feb.-Mar., June-July ..	II	E	10 ft.-10 ft.
*Water Melon ..	Tarbuza ..	Citrullus vulgaris ..	"	P. Jan.-Mar. ..	II	E	5 ft.-5 ft.
Herbs							
Aniseed ..	Sauf ..	Pimpinella anisum ..	Umbelliferae ..	P. Oct.-Nov.; H. Apr.-May..	II	A	1 ft. 6 in.
Basil ..	Gulab tulsi ..	Ocimum basilicum ..	Labiatae ..	P. Oct.-Nov.; H. Mar.-May..	I	A	$1\frac{1}{4}$ ft. 1 ft.
Borage ..	..	Borago officinalis ..	Boraginaceae	P. Oct.; H. Mar.-May ..	I	A	$1\frac{1}{2}$ ft. 1 ft.

Caraway	Jira	Carum carui	Umbelliferae	P. Oct.; H. Mar.-Apr.	II	A	1 ft.-9 in.
Chervil, Salad		Scandix cerefolium	„	P. Sep.-Jan.; H. Feb-Aug.	I&II	A	9 in.-6 in.
Chicory	Kasni	Cichorium intybus	Compositae	P. Sep.-Oct.; H. Mar.-May	II	A	1 ft.-1 ft.
Chives		Allium schoenoprasum	Liliaeae	P. Oct.-Nov.; H. Mar.-May	I	*A	1 ft.-6 in.
Coriander	Dhanya	Coriandrum sativum	Umbelliferae	P. Sep.-Oct.; H. Mar.-May	II	A	1 ft.-1 ft.
Dill	Sowa	Peucedanum graveolens	„	P. Oct.-Nov.; H. Mar.-May	II	A	1 ft. 9 in.
Fennel	Saunf	Foeniculum officinale	„	P. Oct.-Nov.; H. Mar -May	II	A	1½ ft.-1 ft.
*Fenugreek	Methi	Trigonella foenum graecum	Leguminosae	P. Oct.-Nov.	II	A	1 ft.-6 in.
Lavender		Lavandula vera	Labiatae	P. Oct.; H. Mar.-May, Oct.	I	*A	2 ft.-2 ft.
Marigold, Pot	Zergul	Calendula officinalis	Compositae	P. Oct.; H. Mar.-June	I	A	1½ ft -1 ft.
Marjoram, Sweet	Bantulsi	Origanum majorana	Labiatae	P. Oct.; H. Mar.-June	I	A	1 ft.-1 ft.
*Mint	Podina	Mentha viridis	„	P. Oct.; H. Mar.	I	*A	6 in.-6 in.
*Nigellea; Indian Fennel	Kalajira	Nigella sativa	Ranunculaceae.	P. Oct.-Nov.; H. Apr.-May	II	A	1 ft.-6 in.
Parsley	Ajmud	Petroselinum sativum	Umbelliferae	P. Sep.-Nov.; H. Mar.-May	II	A	9 in.-9 in.
Rosemary		Rosmarinus officinalis	Labiatae	P. Oct.; H. Mar.-Apr.	I	A	1 ft.-1 ft.
Rue		Ruta graveolens	Rutaceae	P. Oct; H. Mar.-May	I	A	6 in.-6 in.
Sage	Seesti	Salvia officinalis, Var. tenuior	Labiatae	P. Oct.; H. Mar.-May	I	A	1½ ft.-1 ft.
Savory, Summer		Satureia hortensis	„	P. Oct.; H. Mar.-Apr.	II	A	1 ft.-1 ft.
Savory, Winter		Satureia montana	„	P. Oct.; H. Mar.-Apr.	I	A	1 ft.-1 ft.
Thyme		Thymus vulgaris	„	P. Oct.; H. Mar.-May	I	A	9 in.-9 in.

English Name	Vernacular Name	Latin Name	Natural Order	Time of Sowing	Class	Method	Distance
		Spinach & Sag					
Sorrel ..	Khatta palak ..	Rumex acetosa ..	Polygonaceae ..	P. Oct.; H. Mar.-May ..	II	A	1 ft.-6 in.
Spinach, English ..	Vilaiyti palak ..	Spinacia oleracea ..	Chenopodiaceae	P. Sep.-Nov.; H. Mar.-Apr.	II	A	1 ft.-9 in.
„ New Zealand ..	..	Tetragonia expansa ..	Mesembryaceae	P. Sep.-Nov.; H. Mar.-May	II	A	1½ ft.-1 ft.
* „ Indian ..	Palak ..	Spinacia oleracea ..	Chenopodiaceae	P. Sep.-Mar. ..	II	A	1 ft.-1 ft.
„ Seakale Beet ..	..	Beta cicla ..	„ ..	P. Sep.-Oct.; H. Mar.-May ..	II	A	1½ ft.-1 ft.
*Red Spinach ..	Lal sag ..	Amaranthus gangeticus	Amarantaceae	P. Apr.-July; H. Apr.-July	II	A	1½ ft.-1 ft.
*Portulaca-leaf Spinach.	Kulfa sag ..	Portulaca oleracea ..	Portulaceae ..	P. Mar.-June; H. Apr.-Sep.	II	A	1 ft.-6 in.
*Climbing Spinach ..	Poi sag ..	Basella alba and rubra	Chenopodiaceae	P. June-July ..	I	* A	2 ft.-2 ft.
		Other Vegetables, etc.					
Artichoke, Globe ..	Hatichuk ..	Cynara scolymus ..	Compositae ..	P. Aug.-Oct; H. Mar.-May	I	*D	4 ft.-4 ft.
*Artichoke, Jerusalem ..	Hatipich ..	Helianthus tuberosus ..	„ ..	P. Mar.-June; H. Feb.-Mar.	II	*AI	2½ ft.-1 ft.
Asparagus ..	Paragas ..	Asparagus officinalis ..	Liliaceae ..	P. Aug.-Oct.; H. Feb.-May ..	I	C & D	1½ ft.-1 ft.
Beet ..	Chukandar ..	Beta vulgaris ..	Chenopodiaceae	P. Sep.-Oct.; H. Mar.-May ..	II	A & B	1¼ ft.-9 in.
Borecole, Kale ..	..	Brassica oleracea Var. acephala ..	Cruciferae ..	P. Oct; H. Feb.-May-Oct. ..	I	AI	2 ft. 1½ ft.
Broccoli ..	Chota phul gobi	Brassica oleracea ..	„ ..	P. Sep.-Oct.; H. Feb.-Apr. ..	I	AI	2 ft. 1½ ft.
Brussels Sprouts ..	Boorasel ..	Brassica oleracea, Var. bullatta gemmifera ..	„ ..	P. Oct.-Nov.; H. Mar.-Nov.	I	AI	2 ft. 2 ft.

Cabbage ..	Bund gobi ..	Brassica oleracea, Var. capitata	Cruciferae ..	P. Sep.-Nov.; H. Feb.-May, Oct.	I	AI	1½ ft.-1½ ft.
Cardoon ..	..	Cynara cardunculus ..	Compositae ..	P. Sep.-Oct.; H. Feb.-Apr. ..	I	D	1 ft. -1½ ft.
Carrot ..	Gajar ..	Daucus carota ..	Umbelliferae ..	P. Aug.-Nov.; H. Feb.-May	II	A	1 ft.-9 in.
Capsicum ..	Vilaiyti mirich ..	Capsicum grossum ..	Solanaceae .	P. Aug.-Oct.; H. Feb.-Apr...	I	AI	1½ ft.-1 ft.
*Cape Gooseberry ..	Tipari ..	Physalis peruviana ..	"	P. Apr.-June, H. Apr.-May	I	AI	3½ ft. 3 ft.
*Cauliflower, (Acclimatis-ed	Phul gobi ..	Brassica oleracea, Var. botrytis cauliflora ..	Cruciferae ..	P. June-Aug. ..	I	AI	2½ ft. 2 ft.
Cauliflower, Imported ..	" ..	" ..	"	P. Sep.-Oct.; H. Oct.-Mar. ..	I	AI	2½ ft. 2 ft.
Celery ..	Shalari ..	Apium graveolens ..	Umbelliferae ..	P. July-Aug.; H. Oct.-Mar...	I	D	1 ft.-1½ ft.
Celeriac ..	Gant shalari ..	" Var rapaceum	"	P. July-Aug.; H. Oct.-Mar.	I	A	1 ft.-1 ft.
Chervil, Bulbus ..	..	Chaerophyllum bulbosum	"	P. Oct.; H. Feb.-Apr. ..	II	A	1 ft. 6 in.
*Chilli ..	Mirich ..	Capsicum acuminata ..	Solanaceae ..	P. Apr.-June; H. Apr.-May	I	AI	2 ft. 1½ ft.
Cress, Garden .	Halim ..	Lepidium sativum ..	Cruciferae ..	P. Sep.-Feb.; H. Mar.-Sep. ..	II	A	1 ft. 4 in.
Cress, Water ..	..	Nasturtium officinale ..	"	P. Oct.-Nov.; H. Feb.-June ..	II	A	6 in. 6 in.
Corn Salad ..	..	Valerianella olitoria ..	Valerianaceae	P. Oct.-Nov.; H. Mar.-June	I	A	1 ft. 6 in.
*Egg-plant, Hot season	Brinjal; baingan	Solanum melongena ..	Solanaceae ..	P. Feb.-Mar. ..	I	BI	3 ft. 3 ft.
* " Rainy season	"	"	"	P. June and Sep.-Oct. ..	I	BI&AI	3 ft. 3 ft.
Endive ..	Vilaiyti kasni ..	Cichorium endivia ..	Compositae ..	P. Oct.-Nov.; H. Mar.-May	I	A	1 ft. 1 ft.
*Garlic ..	Lasun ..	Allium sativum ..	Liliaceae ..	P. Oct.-Nov.; H. Feb.-Mar.	II	*A	1 ft. 9 in.
*Ginger ..	Adrak ..	Zingiber officinale ..	Scitaminaceae	P. June-July ..	II	*AI	1½ ft. 9 in.

English Name	Vernacular Name	Latin Name	Natural Order	Time of Sowing	Class	Method	Distance
*Ground-nut; Peanut ..	Mumphali ..	Arachis hypogaea ..	Leguminosae..	P. Aug.-Sep. ..	II	A	2 ft. 2 ft.
Horse radish ..	..	Cochlearia armoracia ..	Cruciferae ..	H. Oct. and Mar.-Apr. ..	I	A	1 ft. 1 ft.
Knol Kohl, Kohl Rabi	Gantgobi ..	Brassica oleracea, Var. caulorapa .	"	P. Aug.-Oct.; H. Mar.-May	I	A	1 ft. 9 in.
*Lady's-finger ..	Bhindi ..	Hibiscus esculentus ..	Malvaceae ..	P. Feb.-Mar., Jun.-July; H. Apr.-June	I	AI	3 ft.-2 ft.
Leek	Vilaiyti piyaz ..	Allium porrum ..	Liliaceae ..	P. Sep.-Oct.; H. Mar.-May ..	I	BI	1 ft.-6 in.
Lettuce	Salaad ..	Lactuca sativa ..	Compositae ..	P. Sep.-Nov.; H. Jan., Aug.	I	A	$1\frac{1}{4}$ ft.-1 ft.
Mushroom	Chattri ..	Agaricus campestris ..	Agaricaceae ..	Instructions to follow ..		*	
Mustard, Garden ..	Rai	Brassica alba ..	Cruciferae ..	P. July-May; H. Mar.-Sep...	II	A	6 in.-6 in.
*Onion	Piyaz ..	Allium cepa ..	Liliaceae ..	P. Oct; H. Mar.-May ..	II	A	1 ft.-6 in.
Parsnip	Jazur ..	Pastinaca sativa ..	"	P. Oct.-Nov.; H. Mar.-May ..	II	A	$1\frac{1}{4}$ ft.-1 ft.
Pea	Matar ..	Pisum sativum ..	Leguminosae ..	P. Oct.-Nov.; H. Oct.-Mar...	II	D	4 ft.-9 in.
Potato	Alu	Solanum tuberosum ..	Solanaceae ..	P. Sep.-Nov.; H. Feb. Apr. .	II	*AI	2 ft.-1 ft.
Radish	Muli ..	Raphanus sativus ..	Cruciferae ..	P. Aug.-Jan. H. Mar., Aug.	II	A	6 in.-4 in.
Rhubarb	..	Rheum rhaponticum ..	Polygonaceae..	H. Oct., Mar.-Apr. ..	I	A	3 ft.-3 ft.
Red Sorrel; Rozelle ..	Patwa ..	Hibiscus sabdariffa ..	Malvaceae ..	P. Apr.-May	I	AI	5 ft.-5 ft.
*Maize	Maki; bhutta ..	Zea mays	Gramineae ..	P. Apr.-June; H. May-June	II	BI	2 ft.-$1\frac{1}{2}$ ft.
Salsify	..	Tragopogon porrifolius	Compositae ..	P. Oct.; H. Mar.-May ..	II	A	1 ft.-6 in.

Sea-kale	..	Crambe maritima ..	Cruciferae ..	P. Nov.-Jan.; H. Oct., Mar.-Apr.	I	A	3 ft.-3 ft.
Shallot	Gandana ..	Allium ascalonicum ..	Liliaceae ..	P. Oct; H. Mar.-May ..	I	*A	1 ft.-6 in.
Strawberry ..	..	Fragaria chilcensis ..	Rosaceae ..	P. Oct.-Nov; H. Oct, Feb.-Apr.	I	*A&B	$1\frac{1}{4}$ ft.-1 ft.
*Sweet Potato ..	Shakarkand ..	Ipomoea batatas ..	Convolvulaceae	P. Apr.-June ..	II	*A&C	$1\frac{1}{2}$ ft.-$1\frac{1}{2}$ ft.
Tomato	Tamatar ..	Lycopersicum esculentum	Solanaceae ..	P. July-Oct.; H. Mar.-May ..	I	AI	3 ft.-$1\frac{1}{2}$ ft.
Turnip	Salgam ..	Brassica rapa ..	Cruciferae ..	P. July-Nov.; H. Feb.-June	II	A&B	$1\frac{1}{4}$ ft.-9 in.
*Turmeric	Huldi ..	Curcuma longa ..	Scitaminaceae	P. June-July	II	*A	$1\frac{1}{2}$ ft.-1 ft.
*Yam	Ratalu ..	Dioscorea species ..	Dioscoreaceae	P. Feb.-Apr.; H. Mar.-May ..	II	*E	5 ft.-5 ft.

Fodder Plants

Lucerne	..	Medicago sativa ..	Leguminosae ..	P. Sep.-Oct.	II	AI	$1\frac{1}{2}$ ft.-1 ft.
Berseem	..	Trifolium Alexandrinum	"	P. Sep.-Oct.	II	AI	$1\frac{1}{2}$ ft.-1 ft.

A NOTE ON RAISING CALVES

DAIRY DEPARTMENT, A.A.I., ALLAHABAD

Importance of Raising Dairy Calves.—The only sound way leading to permanent success in dairying is to raise and develop your own herd. There is considerable destruction of young calves taking place in large cities where the Gowalas are not interested in raising their calves. In the city of Calcutta alone 90,000 cows are annually sent in. It is common knowledge now that not even 5 per cent of these cows are replaced by their progeny. The cows, after giving milk for one lactation, only go to the butchers. Thus there is a heavy drain on the stock store. Besides, only the best animals are sent to these cities because they bring better prices, with the result that the breeding centres are left with an inferior quality stock on hand to breed to. Deterioration of cattle in India is obvious. The best remedy to counteract this is to raise the calves from these best animals and build up the future herd.

With this end in view, the following note is given. It is presumed, however, that the calves to be reared are by hand-feeding. Hand-feeding is more economical; at the same time, weaning the calves from their dams relieves one of the various disadvantages consequent on the death of calves.

Care of the Cow and the Calf before and after Calving.—In order to assure a calf a proper start in life, it is necessary that the cow be given proper care and feeding before and after the time of calving. She should be cared for and fed in such a way that she will calve easily and normally and recover rapidly from the effects of calving and start her lactation period in good health. Proper management at this time means more living calves, fewer sick cows, and better chances for longer periods of greater milk production. All authorities on dairying agree that a cow should have rest between lactation periods not only to replenish the lost nutrients from her body, but also to provide sufficient nutrients and energy to the rapidly-growing fœtus. It is during the last two or three months of the gestation period that the growth of the fœtus is very rapid, and hence draws on a considerable amount of the nutrients supplied to the cow. Cows that calve without drying drop off a weak calf, and also it affects the subsequent lactation period.

Care of the Calf at Birth.—As soon as the calf is dropped, it is to be removed from the cow before she sees it. The cow should also be transferred to another paddock. The calf should be thoroughly cleaned up with dry straw or gunny bags, and prompt attention should be given to the fact that the breathing is established. Mucus should be removed from the mouth and the nostrils. After drying up the calf thoroughly, to avoid the danger of infection, the navel of the calf should be painted with tincture of iodine. The best way is to tie the navel with catgut or twine about 1½

inches from the belly, cut off the rest with a pair of scissors, and then saturate the navel with tincture of iodine. A normal calf will attempt to rise within 15 to 20 minutes of its birth.

Teaching the Calf to Drink Milk from a Pail.—By instinct the calf stretches upward to receive its nourishment; in learning to drink, it must be taught to reach downwards. If the calf is allowed to go without milk for 5 or 6 hours after birth, it becomes very easy to teach the hungry calf. Put your fingers in the milk and allow the calf to suck. Then try to take away your fingers, slowly allowing the calf to suck milk only. Care should be taken, when taking out your fingers, that the calf does not suck air only as this affects digestion by causing flatulence. It is necessary that the calf receive the colostrum milk only in the beginning. The colostrum is specially suited to the requirements of the young calf. This milk is high in albumin and ash content; it also acts as a laxative, cleaning out the digestive tract of the calf, and also keeps down the undesirable bacterial growth in the intestines.

Feeding Whole-milk.—Until about 5 weeks of age, the diet of the calf should consist almost entirely of whole-milk. Because of the small capacity of the calf's stomach, it is advisable in hand feeding to divide the milk into three feeds per day for the first week or 10 days, and later on into two feeds per day.

Feeding Skim-milk.—If the calf (Scindi breed) seems thrifty, the change to skim-milk may be started at the beginning of the sixth week. The change, however, should be made gradually. The following schedule would roughly indicate the routine to be followed for feeding:—

MILK-FEEDING SCHEDULE

Age of Calf (Scindi breed)	Pounds of Milk per Day	
	Whole Milk	Skim-milk
1 to 7 days ..	4 lb. mother's milk in 3 meals ..	0
7 „ 21 „ ..	5 „ (whole-herd milk in 2 meals)	0
21 „ 35 „ ..	6 „	0
36 „ ..	5½ „	½ lb.
37 „ ..	5 „	1 „
38 „ ..	4½ „	1½ „
39 „ ..	4 „	2 lbs.
40 „ ..	3½ „	2½ „
41 „ ..	3 „	3 „
42 „ ..	2½ „	4 „
43 „ ..	2 „	5 „
44 „ ..	1 „	6 „
45 „ ..	0	7 „
7 to 8 weeks ..	0	8 „
9 „ 11 „ ..	0	10 „
3 „ 5 months ..	0	12 „
5 „ 6 „ ..	0	Gradually reduce the skim-milk by displacing ½ lb. skim-milk with water.

Feeding Grain.—Whole-milk alone is a satisfactory feed for a young calf; but, when the change to skim-milk is made, some other feeds to supply the necessary energy in place of fat from milk is required. At this time grain should be supplied. To induce the calf to eat grain, a handful of wheat-bran should be given to the calf after milk-feed from the beginning of the fourth week. This will accustom the calf to eat grain; at the same time, it will drive away the milk taste of the calf's mouth, and thus protect the calf from forming the habit of sucking other calves. After he has learnt to eat grains, a mixture of crushed oats, one part, wheat-bran one part, and linseed meal half-part will be found useful. A calf about 3 months old should be given 1½ to 2 lb. of grain mixture a day; up to 6 months the calf need not to be fed more than 3 to 4 lb. grain mixture a day.

Feeding Roughages.—At birth, a calf's rumen is much smaller as compared to its fourth stomach; but, as it grows, the first stomach grows in size and becomes many times larger than the fourth. It is on account of this that the calf is unable to handle any amount of coarse food in the beginning; but, later on, usually by the beginning of the fourth week, it shows an inclination to nibble at grasses, and this is the time when the calf may be allowed clean hay; the calf may be allowed all the hay it will clean up.

Points to be Observed in Calf Feeding

(1) Use only fresh milk—cold milk one day and hot milk the next day upsets the calf;

(2) Feed regularly; whatever schedule is decided upon, it should be followed with close regularity. The calf is a creature of habit; any interruption in the routine disturbs the calf, and may lead to digestive troubles;

(3) Avoid overfeeding. It is wiser to slightly underfeed the calf than overfeed;

(4) Provide the calf with clean, fresh water all the time;

(5) Feed according to the condition and the appetite of the calf, and not according any rule of thumb;

(6) A mineral brick or rock-salt should always be put before the calf for licking; this will prevent it from licking earth and contracting parasitic diseases; and

(7) All utensils used for feeding milk should be scrupulously clean.

Further Suggestions on Calf Management

(1) *Housing.*—To raise healthy calves, they should be provided with clean, well lighted, and airy stalls. They should be carefully protected from cold drafts, dampness, and "luh."

(*Continued on page* 173)

GRAPE-FRUIT IN INDIA

By W. B. Hayes

Great interest in the grape-fruit is being shown at present in this country, yet few people seem to know much about this fruit. This interest is due to a number of causes, among which are the popularity of grape-fruit in other countries, the presence of small numbers, locally grown and imported, on the Indian market, and a considerable amount of extravagant advertising. That this fruit offers possibilities of great value cannot be denied, but persons who make large investments in it without a thorough investigation may find it a costly venture.

Much uncertainty and confusion surround both the history and nomenclature of the grape-fruit. In this article the term "grape-fruit" will be used for the fruit which has attained commercial importance in America under this name, as distinct from the pomelo *(chakotra)* of India. The grape-fruit probably originated in the West Indies as a seedling or sport, although some writers have supposed it to have been brought there from China. Certainly it came into prominence in America; and the grape-fruit now grown in India has come from America.

The names shaddock and pomelo, both variously spelt, have been applied to the group of citrus fruits containing both the grape-fruit and the *chakotra*. The former name comes from Captain Shaddock, who is credited with having brought the first seeds of this fruit to the West Indies. The name pomelo (pummelo, pumelow, etc.) is probably derived from the Dutch name, pompelmoes, although some authors derive it from *pomum melo*, meaning melon-fruit. To make matters worse, the name pomelo has been officially recognized in America as the correct horticultural designation for the grape-fruit. Botanically, the situation is no better. The inclusive group has been known as Citrus decumana, C. grandis, and C. maxima, while the grape-fruit is considered either a variety of the above, or as a distinct species, paradisi.

The grape-fruit is distinguished from the typical shaddock in being a somewhat larger tree (sometimes 50 feet in height), with smooth, glossy, dark-green leaves; whereas in the shaddock the leaves and young branches are somewhat hairy. The fruit does not reach the immense size of some shaddocks, has a thinner rind, and a distinct flavour, which is a blending of sweet, sour, and bitter. It is more juicy, and the juice sacks are closely packed together. In quality, it is superior to the average shaddock, though some varieties of the latter are of equally high quality.

Of the commercially important citrus fruits, the grape-fruit is the latest to reach prominence. It is first mentioned in the

West Indies, probably as early as 1750, under the name "Forbidden-Fruit Tree;" the name grape-fruit was used by the year 1814. The first plantings were made in Florida by about 1809, but for many years the fruit was considered little more than a curiosity. The first commercial shipment was made between 1880 and 1885, and the fruit soon became popular in the northern markets. This led to very extensive plantings in Florida, and later in California, Arizona, and Texas. The grape-fruit is also grown commercially in the West Indies, Palestine, and South Africa. Plantings amount to more than 150,000 acres, much of which is not yet in full bearing. The market has continued to expand as production increased. In 1921 England imported about 35,000 boxes of 75 pounds each; in 1929 this figure had grown to 850,000 boxes. More than two-thirds of this amount came from the United States.

While the pomelo has been grown in India for many years, the grape-fruit is a recent introduction, and should be regarded as still being in the experimental stage. A few scattered plantings have been made in the Punjab, some of which have come into bearing. These seem to be doing well, and indicate the possibility of developing the industry there. Small plantings have doubtless been made in other parts of the country. The Allahabad Agricultural Institute received in June, 1932, 25 trees each of three leading varieties from Florida. While these are thriving thus far, it will be several years before much can be said about them.

During the last few years certain nursery companies in Calcutta have been circulating rather extensive advertising material. Objection can be taken to several features of this propaganda. It is doubtful whether there has yet been sufficient experience to justify the claim that the grape-fruit succeeds in practically all parts of India, and that it is a very profitable crop. Some of the variety names used have no recognized standing, and the implication that these are prominent American varieties is false. Planters are advised to plant these trees only 14 feet apart, whereas well-grown grape-fruit trees should be planted at a distance not less than 25 feet.

Prospective growers should assure themselves of the reliability of the nursery before placing extensive orders. The writer knows of at least one case in which trees supplied by a Calcutta firm as grape-fruit have turned out to be *chakotra*. As most growers will not be able to distinguish between the two until fruit matures, caution is desirable.

There can be no doubt that the grape-fruit offers valuable possibilities to the Indian fruit-grower. This is a fruit of high quality and unusual dietetic qualities. A demand for it is already being developed, and this can doubtless be greatly expanded. Grape-fruit grown in the Punjab have sold for as much as 8 annas

each, while Jaffa (Palestine) grape-fruit were recently noticed in Cawnpore selling for 6 annas. Under favourable conditions the trees bear heavily. It remains to be proved, however, whether the grape-fruit will be a permanent success in this country; and, if so, in what regions it can be grown to the best advantage. Much work remains to be done in order to discover the best varieties for this country, and the best stock on which to grow them. This will take time.

In the meantime, only those should make extensive plantings who are in regions where grape-fruit is being successfully produced, and who can secure dependable stock, or who can afford to take large risks. Others, by experimenting with a few trees, can contribute to the fund of information about this promising fruit. The writer would be glad to hear from any who are growing grape-fruit, or who have had experience with it.

(*Continued from page* 170)

(2) *Lots.*—It is advisable to separate the calves in different lots according to their size and age. This prevents stronger calves bullying weaker ones.

(3) *Marking Calves.*—For purposes of identification the calves should be numbered as soon as they are born. A numbered tag may be tied around their neck. Later on, either steel ear tags may be given or they may be tattooed.

Common Ailments of Calves

(1) *Scours from Indigestion.*—Diarrhœa, or scours, is the most common disease of calves. It may be caused by irregular feeding, overfeeding, feeding dirty milk, or feeding in dirty utensils. Segregate the calf as soon at it is detected. Investigate and remove the cause. Give a dose of 1 to 2 oz. of castor oil, followed by a teaspoonful of a mixture of one part salol and two parts subnitrate of bismuth.

(2) *Lice.*—These cause a good deal of trouble especially among the buffalo calves. A decoction of tobacco applied once or twice will relieve them of this pest.

(3) *Intestinal Parasites.*—These cause a great deal of loss in calves. The following mixture, kept in boxes for lick, may help in preventing infection: 200 lb. salt, 15 lb. sulphate of iron, 15 lb. sulphur, 125 lb. slaked lime.

EROSION AND ITS CONTROL

By Mason Vaugh

Agriculturists have only recently awakened to the tremendous losses caused by erosion. It is such an ever-present phenomenon, so universal the world over, that it is generally taken for granted that it is inevitable. It has carved the Himalayan mountains to their present shape. The results of corrosion have filled the Bay of Bengal with the material cut from the hills so that places once on the sea-coast are now hundreds of miles inland, on soil thousands of feet deep. Erosion is continually tearing down one place for material with which to build anew. Some of the richest lands to-day are the results of the erosion of previous times. Likewise, some of the desert places, or at least places uninhabited and unfit for habitation to-day, have been made so by erosion.

While it is true that material eroded from one place only goes to build up another, the building-up process is a long-time one. The land we now have is ours, and we can now and here use it. Whatever might be built of it, would not be available to us or our children, and our first, and greater, duty is to ourselves and them. To the farmer the soil is his capital, and, to a large extent, his raw material and factory building and equipment. If it is spoiled, his whole business is gone or damaged, and reduced to the same extent that his soil is damaged. Many of us worry about the exhaustion of the soil by the removal of plant-food in crops grown. Few of us realize that the loss of fertility through erosion during one heavy rain-storm may be more than that taken from the fields by ten crops.

There are two chief types of erosion. The one called gully erosion is familiar to all. Thousands of acres of land throughout the Gangetic plain, but especially along the Jamna River, are made useless by the large gullies which scar the country-side into miniature mountain-ranges and valleys impossible to cultivate and usually too poor to support anything except scanty grass and weeds. These go on year after year eating back farther and farther into the good fields surrounding them, sending out additional branches on all sides. Gullies are apt to form wherever water descends abruptly from one level to another. Once started, they eat back continuously. Many extend to a length of 2 or 3 miles, ruining as much as 10 to 15 acres of otherwise fertile land.

The other type, known as sheet erosion, is not so commonly recognized, though it is common everywhere. Examination of any field having a perceptible slope after heavy rain, especially rain falling when the soil is freshly ploughed and loose, or when not covered and protected by a dense crop, will show little furrows, miniature gullies cut where the water has run down the slope, and

at the foot of the slope a deposit of silt carried down from higher up. Usually, the gullies, or little furrows, are only a finger's length or less in depth and often less than a finger's thickness in width; the next ploughing obliterates them, and we give the matter no thought. If it were only a matter of removing soil from the higher parts of the field and depositing it in the lower, perhaps we would consider it a desirable process. Unfortunately, it is not. Much of the soil removed from the higher places does not stop in the lower part of the field. It is carried out of the field completely, goes into the streams, and finally serves to further clog the outlet of the Ganges and to fill up the Bay of Bengal. The residue we see is only the heavier particles, too heavy for the water to carry a way. The finer particles, which contain the fertility of the soil and the manure and organic matter, are mostly carried away and lost.

Several articles, or even books, could be written on the damage done by erosion. This has been mentioned in previous articles in other issues of the *Farmer*, and need not be further stressed here. More important is to know what to do about it so that damage can be prevented or remedied where it has occurred already.

To understand the control of erosion, we must first understand a bit about how and why it occurs. Flowing water can transport soil from place to place more or less easily, depending on the nature of the soil and on the velocity with which the water flows. The nature and condition of the soil influence erosion in that, the harder and denser the soil is, the more difficult it is to dislodge in the first place. Conversely, loose, freshly-worked soil and friable, soft soils are more easily dug than hard, compact soils. Fine-grained soils, clay and silt, are more easily carried than are the heavier sand particles. The power of water to erode and transport soil particles varies with the velocity, the rate of variation being as the sixth power of the velocity. That means that doubling the velocity means increasing the power to erode and transport 48 times. The velocity with which the water will flow depends on the slope of the land down which it flows. The greater slope will produce the greater velocity. The velocity and the eroding power also vary with the amount of water flowing; that is, a concentration of water into a small stream is more dangerous than is a small amount.

The problem thus comes to one of controlling the amount of water flowing down any given slope and the velocity or speed with which it flows. To apply a political phrase, "to divide and rule" should be the basis of our methods of controlling erosion. Within the field itself the water must be so controlled that it does not accumulate into dangerous amounts, and it must be taken down the slope in ways which are under control so that the safe velocity may not be exceeded. The "safe velocity" will be governed by the

material over which it flows. For loose, sandy soil it must be very low; for compact, hard clay soils it can be higher; if the ditch is choked with vegetation and the soil is held by roots, the velocity can be still higher; and, where pakka spillways or other devices are used, the velocity may be as high as that due to direct vertical falling.

Many different methods have been suggested for controlling the water running off our fields. The Indian farmer's method is to try to level every plot of land and to put an embankment round each field in such a way that water cannot run off at all. This was probably the best that could be done in olden times with mostly hand labour and very small plots. Where the land is already quite level and quite porous so that the water is quickly absorbed, it quite effectively prevents erosion. It brings, however, in its train several disadvantages to offset its advantages. Little of the land is level enough to make such methods possible without an enormous amount of labour to level off high places and fill low. Bunds high enough to contain normal light rain are insufficient to hold the very heavy, even torrential, rains occurring during the monsoon season. Water accumulates until it breaks over or through a rat hole, becoming an uncontrolled torrent capable of doing much damage. Where no break occurs, the lower parts of the fields become waterlogged or saturated during the rainy season and are not only spoiled for that season, but are rendered less fertile for the following winter crop. By all means let us encourage absorption; but this is usually not best done by keeping the soil saturated for long times. Deep ploughing has often been recommended as a method of encouraging absorption, and so pretenting run-off and erosion. It is quite effective where the rains are light, half an inch or so at a time, and well separated. In monsoon conditions deep ploughing is all right if other steps are taken to control the water; but, where run-off occurs over deeply-ploughed land at a rapid rate of flow, the damage is likely to be increased, instead of lessened.

Observation and experiment have shown that two devices are especially valuable in controlling erosion—the so-called soil-saving dam, and the broad-based terrace. The soil-saving dam is a device for the control of erosion which is forming, or is likely to form, gullies; the broad-base terrace is a device for controlling the flow of water across a field or down a slope, while preventing damage. It would make this paper too long to attempt a description of both methods in it so we will briefly discuss the soil-saving dam, leaving the terrace to another paper.

The essential features of a soil-saving dam are that there shall be a dam of some material sufficiently strong not to be broken by the pressure of the water against it and of such water-tightness that the water shall not soak through, combined

with a suitable spillway through or over which the water may pass without cutting away the dam. The dam proper must be built in such a way as to cause the gully above it to fill up with water nearly full. It must be higher than the spillway so that the water will all be passed through or over the spillway, and not over the dam.

The dam can usually be made of dirt only. The place where it is to be built should be thoroughly cleared of all grass, and weeds, brush, stumps of trees, etc., should be dug out, root and all. The height of the dam should be estimated, and the base made three to four times as wide as the height plus the width of the top. Whenever possible, the dam should be made with moist earth, or the earth should be wet as it is put in place and well tramped or beaten down. Generally, the dirt for the dam can be dug from a hole on the upstream side of the dam in the bottom of the gully to be filled. The dirt taken out will then be replaced by that washed into the gully by erosion from the surrounding fields. As soon as possible after the dam is made, it should be seeded or planted to some strong-growing-resistant grass which will help to hold the dirt in place and to keep the dam from wearing down.

The spillway is the most important part of a soil-saving dam. It must be made of some material which will not be affected by the water, such as brick or clay tile pipe. It must be made in such a way that all the water, in even the heaviest rains, can be cared for by it, and so that the water will flow only through it, and not over any part of the earth dam.

There are two types of spillway in common use. For small streams of water an ordinary clay tile or concrete pipe is laid under the earthen dam with an elbow or bend at the upper end with a short piece of pipe placed upright in it so that water will only enter it after the place behind the dam has filled nearly full. The inlet to the pipe can also be made of brick if more convenient, additional layers of brick being added as silt fills in round the pipe. Care must be taken to always keep the inlet enough below the top of the dam so as to avoid any possibility of water flowing over the dam top. Also care must be taken that the pipe is large enough to carry all the water likely to flow in the gully, even during very hard rain. If the pipe is not large enough, the pool will fill up and the excess will overflow the dam, almost certainly leading to its destruction. On nalas or gullies carrying more water than can be taken through an ordinary pipe, a channel may be made of brick floor and walls, and a roof of reinforced construction, either concrete or brick, or even stone slabs where these are available cheaply. The opening to such a channel can be built up of brick above the dam. A hole to drain off the water at the

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GRAIN STORAGE

By S. R. Misra

In India better and successful farm grain storage is too important a problem to be ignored much longer. As better produce and higher production depend, among other things, on better seed, better and successful grain storage is a stern necessity. Though, no doubt, there are compelling reasons for the Indian agriculturist to sell most of his produce at the threshing time, yet even the most petty farmer does put in some grain for eating, at least to carry over to the end or middle of the rainy season. When this grain is finished, he buys or borrows grains, both for eating and for seed, either from some one of his neighbours or the local bania. This injudicious system leads to lower production and higher cost of seed. If he only reverses this system, that is, keeps the good grain for seed, and buys or borrows for eating, if needed at all, he will reap double advantage. But this is not so because, besides other disabilities, the Indian farmer does not yet know the sure way of storing his grains successfully. The success of the indigenous methods of storing grains depends mostly on "luck" or chance. The long period of threshing in the hot sun in April and May serves as a blessing in disguise inasmuch as the high temperature of the summer kills insects in the threshed grains unless interrupted unusually by cloudy weather. When he once fills his grains in numerous country-fashioned bins and seals them up, he does not know what is happening with his stored grains until after he reopens them for his final requirement. If the grain kept in good condition, well and good; if not, he endures it patiently as something "khudai" beyond his control. The bhusa covering, as used in indigenous grain storage, acts as a repellent; that is, it prevents the coming in of outside insects, and also keeps away the moist air in the rainy season; but, at the same time, it also promotes heating of grain, which is a favourable condition for multiplying insect life. If there is a single weevil left in the grain, it is enough to breed and multiply and damage partly, or completely, the stored grain. It is not generally the successful producer, but the successful storer, who earns the greater margin of profit. It is a well-known fact that the Patna growers draw their income from the sale of seed potatoes to almost the whole of Northern India. We at the Institute have been growing Pusa 4 wheat since 1916, and have been selling seed wheat to distant and local farmers ever since. They all grow the same wheat that we have, but there has not been a single year so far that we have not sold our seed wheat to the same farmers, and others as well.

I give below an account of our experiences of storage of several years during the course of which many difficulties have been overcome and improvements effected which should prove of interest to persons interested in the subject. In the beginning we also started with the country method of storage, and have shared the same fate as the Indian farmers do. At sowing time, when we would remove the bhusa covering, we would often find that the seed grains were turned to flour, and then we had to run to the local market to purchase seed to sow our fields. It may be noted here that, as we are short of buildings, we don't have a proper store yet. We have been using the basement rooms of the engineering building as a grain store which, in fact, were designed to store wood for seasoning, etc. We were worried at the desi way of storing grains, and were on the look out for following some better method. Later, we began to store our grains in bags and open bag-bins,* using bag-sheets as covering for stored grains during the rainy season only. This method, though not quite satisfactory, was much better than the bhusa storage. We could at least detect the attack of weevils on the grains and do the needful in time to discourage or prevent them from further attack. The disadvantages of this system of storage were—

(*i*) Grains in the bags were much more weevilly than the enclosed heap grains so the former always sustained more loss and reintroduced weevils to the heap grains;

(*ii*) Bag walls provided too much air spaces, which were unfavourable for fumigation;

(*iii*) Too many bags all around in the room provided ample hiding and breeding-places for weevils and insects;

(*iv*) Too many bags were damaged and worn out every season;

(*v*) Usually, heavier dosage of fumigants was required, yet fumigation would not be quite effective;

(*vi*) Store labour was more expensive because of regular arrangements of bags and grains required; and

(*vii*) Grains could not be stored in deep piles so more floor space was required in storing.

It required about 2,500 square feet of floor space consisting of four rooms, sometimes more than that, to store our storable produce from over 200 acres when stored in bags and bag-bins. In July, 1931, the Institute succeeded in adding 300 acres more to the abve area. We needed more space for storage. In view of the B.Sc. classes to be started from July, 1932, the upstairs room was

*Bags full of grains, tied or sewed up, were walled up by being piled up one upon another enclosing a rectangular open space with the room walls. This enclosed space served as a bin for storing grains.

to be vacated from storage for holding classes so we had only about 1,700 square feet of floor surface to store the produce from over 500 acres. On the former area we had to store about 1,500 maunds every year. This was a difficult problem to be tackled. We decided to make brick-bins which were designed by the Institute Agricultural Engineering Department, under whose guidance the bins have been made. The new brick-bins were made in March, 1932, before the rabi harvest was started. Of the total floor surface of 1,700 square feet, the total binned floor space is only 800 square feet, which consists of eleven bins. The seven small seed-bins together have about 1,000 cubic feet capacity on about 200 square feet floor space, enough to hold about 600 maunds of grains. The two big bins for storing cattle feed-grains have together about 1,800 cubic feet capacity on about 290 square feet floor space—enough to hold about 1,100 maunds of grains. The two wheat-bins together have about 1,600 cubic feet capacity on about 300 square feet floor space—enough to hold about 950 maunds of grains. So all these bins provided on less than half of the available floor area a space to store more than 2,500 maunds of grains. The bin-walls are 4.5″ thick, brick laid with cement mortar, the proportion being one part cement and three parts sand. The bin walls are about 7′3″ high near the room wall, coming down to 5′4″ height in front, so that a man with a head-load can throw the grains direct into the bins. Each bin, according to its size, has one or two holes 1′5″ by 1′4″ at the bottom of the front wall through which grains are taken out; a man can also crawl in and out of the bin. Each hole is shut up from the inside of the bin by a wooden board 2′ by 1′6″ when grains are filled in. The bin construction cost us Rs. 173-8 net for the eleven bins. The small bins cost more than the big ones. If this cost is distributed on the grain-holding capacity of the bins, the very first year it comes to about 1 anna $1\frac{1}{2}$ pies per maund, or about 1 anna 11 pies per maund on our actual amount of storage last year. If this cost per maund is further distributed on the life of a bin, as it should be, it will come to a pie or fraction of a pie. The advantages of these bins to us have been—

(*i*) Our problem of storing the storable produce from more than double area on the then available space was solved without going into the cost of building a new store, leaving yet more than half the space for other storing use or making more bins if required;

(*ii*) The daily or seasonal labour expenses in the rearrangement of stored products have been cut down to about 80 per cent;

(*iii*) Available store-room space for cleaning, etc., has been

much increased, and lurking-places for weevils have been greatly reduced;

(*iv*) Grains are stored much deeper, and the surrounding walls are air-tight, unlike the bag-walls, so less dosage of carbon bisulphide is required with the greater and longer effect of fumigation;

(*v*) There is ample provision of ventilation for the respiration of stored grains so that grains do not heat, which is an unfavourable condition for insects; and

(*vi*) With bag-sheet covering on the top of the bins there is sufficient protection against moist air during the rainy season. I doubt whether our bins and arrangements for grain storage are ideal yet, but nevertheless they are most satisfactory under the existing circumstances at the Institute.

Fumigation

After trying out several methods of fumigating grain stores, we have at last found two fumigants—Cyanogas "G" Fumigant and carbon bisulphide—most satisfactory, which, if wisely administered, can keep grains perfectly safe from all weevils and grain insects.

Cyanogas "G" Fumigant.—It is a slate-coloured granular material which gives off hydrocyanic acid gas, a most deadly gas, when exposed to humid atmosphere. This gas is lighter than air so fills completely all the space and penetrates all nooks and cracks in the room or bin. In foreign countries hydrocyanic acid gas (HCN) has been used in killing grain insects by dropping potassium cyanide wrapped in paper in dilute sulphuric acid, but this operation is attended with the greatest risk to the life of the operator, and is handled only by highly skilful persons. Cyanogas "G" Fumigant is a much safer form of using hydrocyanic acid gas. Its safety lies in the fact that it liberates its gas slowly, and is not so dangerous during the period of application if the operation is done sufficiently quickly and steadily, and the total content of the gas liberated is the same as the hydrocyanic acid gas. The minimum relative humidity and temperature in the room or bin to be treated should be 60 per cent and 65° F. respectively. The two most important points to be borne in mind for the success of fumigation with "G" Fumigant are humidity and air-tightness. The temperature is all right the year round in India except the coldest month of January. Two pounds, or one seer, of this fumigant should be used per 1,000 cubic feet space when the room or bin is quite air-tight; if not, more has to be used.

Complete Process of Fumigation.—(1) Raise the humidity of the room or bin by sprinkling water on the walls and ceiling and

hanging several wet bags three or four hours before starting the application; too much water must not be used; (2) all possible air-vents must be closed and sealed from the inside with mud plaster or something else *to ensure perfect air-tightness*; (3) windows and doors must be left unbolted from the inside so that after the period of fumigation they can be opened from outside; (4) calculate the cubic capacity of the room or bin and keep ready the amount of "G" Fumigant required in cans or bottles, and do not remove the lids until ready to spread; (5) take a bottle of ammonia, from which frequent inhalations should be taken during and after the application of the fumigant; (6) begin spreading from the farthest corner of the room or bin and finish the material by the door; (7) spread the "G" Fumigant *thinly and evenly only on dry spaces*; it must not be spread where water has accummulated or where to is too wet; (8) do the operation carefully, quickly, and steadily, step out of the door instantly on finishing the spreading, and shut the door tightly behind you; (9) keep off children, men, and animals from going near the room during fumigation; and (10) after 36 or 48 hours, open windows and doors from the outside. Let air pass in and out of the room for one day, and then enter the room and clean the residue. The residue is perfectly harmless. All insects and weevils in all stages of their development, rats, etc., in the fumigated store are killed, but the grains are perfectly good for eating and seed. The "Cyanogas" Fumigant does not affect the grains adversely at all. This material is most suitable for fumigating empty store-rooms or bins, and is also used in partly full stores and with grains stores.

We got from Messrs. Shaw, Wallace & Co., 4, Bankshall Street, Calcutta, 75 lb. of Cyanogas "G" Fumigant, at Re. 1-8 per pound, for Rs. 120-8, including freight, which comes to about Re. 1-9-9 per pound. Two pounds, or 1 seer, is enough to fumigate 1,000 cubic feet space, which will hold about 600 maunds of grains; that is, the cost per fumigation per maund is slightly more than 1 pie. Recently we fumigated one of our store-rooms of 6,000 cubic feet capacity with 12 lb. of "G" Fumigant costing Rs. 19-5; 6,000 cubic feet capacity can accommodate 3,500 maunds of grains; but, distributing this cost over 1,500 maunds of grains which we actually store in that 6,000 cubic feet capacity room, the cost per fumigation per maund comes to 2½ pies.

Carbon Bisulphide.—Bisulphide of carbon (CS_2) is a compound of carbon and sulphur; carbon bisulphide is a clear, colourless liquid with an offensive odour. It is poisonous, volatile, and very inflammable. It vaporizes rapidly, giving off fumes heavier than air, so they sink down and permeate through the mass of grain, killing all kinds of insects in all their stages of development present in the grain. This is the most suitable fumigant for stored grains,

cheap, and easiest to handle. It carries no risk to the operator unless he is is a smoker who fails to resist the temptation to light his cigarette or bidi on the place almost instantly after finishing the application. Its efficiency depends on *air-tightness and temperature*, of which the former one must be most cared for. Five pounds of carbon bisulphide are required per 1,000 cubic feet space when the room or bin is quite air-tight and the temperature is 70°F. or over; one pound for 100 maunds of stored grains; in insufficient air-tightness more should be used.

After ensuring air-tightness, calculate the amount of carbon bisulphide needed according to the cubic feet of space to be fumigated. Fill several earthen dishes (which can be obtained in every village) with the fumigant and place them on the surface of the stored grains, or bits of cloth or cotton can be wetted with this liquid and put on the grains. It can be applied directly on the grains without any disadvantage. After applying it, cover the grain heap with bags or blankets on the top of, and around, the bin. After this step out of, close, and lock, the room. Reopen the room after 24 or 36 hours. After opening, let some outside air pass and then enter. On account of its highly inflammable character, the carbon bisulphide carries with it the greatest fire hazard. All kinds of fire and smoking apparatus must be kept away from the fumigated place during the period of fumigation and until it is thoroughly aired out after fumigation.

The best way of keeping the stored grains perfectly safe from insects is to fumigate the store some time in December, February, or March, when it is empty of grains, with Cyanogas "G" Fumigant; fumigate the second time in June, when all grains are stored in the store, with carbon bisulphide; fumigate again the third time in August or September with carbon bisulphide; then in October and November the grains are disposed of for seed and eating. This is what we do, but it can be adapted to any particular individual requirements. These three fumigations together cost us about 7½ or 8 pies, or less than 3 pice per maund, for the whole storing period; the cost of 8 pies per maund really amounts to nothing when compared with the loss otherwise incurred in storage. The after-success of fumigation depends on the absolute cleanliness of the grain store. It should be occasionally swept; the floor, walls ceiling, and all the sweepings, having no commercial value, should be burnt.

Advantages of Grain Storage

(1) Storage of grains makes possible a system of more orderly marketing; (2) it gives the farmer an opportunity to study the market conditions, mark the price trends, and sell his produce at a

time when the market seems most favourable to him; (3) it allows time and space for cleaning the rubbish, foreign materials, weeds, seeds, etc., from the grains which, when cleaned, bring a higher price and the cleanings are utilized on the farm, feeding cattle, horses, chickens, and etc., (4) it allows the storage of more reliable home-grown seeds in better condition for one's sowing and sale at a higher price.

If Indian agriculturists knew the advantages of grain storage, and also knew the way of reaping the fruit of full advantages of storage by using sure-success fumigants, as are the above two, much economic loss would be prevented. The farmers, being the producers, should naturally be successful storers; but it is really sad to see only the local banias and sahukars, and not the producers, reaping the full advantages of storage. Let some follow our method of storage and fumigation and see the result. Our study of the numerous beetles and moths infesting the stored grains is not complete yet, but we hope to give further information on this later.

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end of the monsoon may be left and closed with a bit of wood or stone. The size of channel necessary can usually be estimted by watching the amount of water which flows just during or after very heavy rain.

The other common type of spillway is simply a wall of brick, or, where cheaper, of stone masonry or concrete, over which the water can flow. Usually, this is much less in width than the width of the nala, and the remaining part of the dam can be made of earth. It is necessary in all cases to provide sufficient spillway to care for even the heaviest rains, and there should be a stone or masonry floor or other device at the foot of the spillway to break the force of the falling water and to prevent the undermining of the spillway. The spillway wall may be straight in the case of small dams where the spillway is only a few feet long, but in longer ones it should be curved upstream so that the wall acts as an arch, making any reinforcement unnecessary.

Rotational grazing of grassland can be practised with considerable benefit to both the grassland and the cattle. The ideal method is, after bunding the area, to fence the land into paddocks. The milking herd moves from one paddock to another, staying about four days in each paddock. The milking herd is followed by the dry or young stock.

Manure is most valuable when lightly applied on sandy soils.

THE RELATION OF MILK PRODUCTION TO INCOME FROM DAIRY COWS

By N. R. Joshi

The efficiency wave that has been sweeping over factories and business concerns during recent years has also reached the farms and dairies. Cheap land, cheap labour, and low standards of living have enabled the farmer until now to drag on without much attention to the efficiency of his management. With the present depression of prices of agricultural produce it is important that the farmer pay attention to the efficient management of his farm and to the calculation of costs of production. It is known to every experienced dairyman that the income from a dairy farm is ultimately dependent on the earning capacity of his individual cows.

The cost of feed is the major item entering into the cost of production of milk. The purpose of this paper is to present information from the records of the Agricultural Institute Dairy, Allahabad, and to show the relation between the cost of milk production—the productivity of individual cows and the income received.

The data is from the feed and milk records maintained by the Agricultural Institute. The prices of feeds were the ruling prices on the Allahabad market during October, 1932.

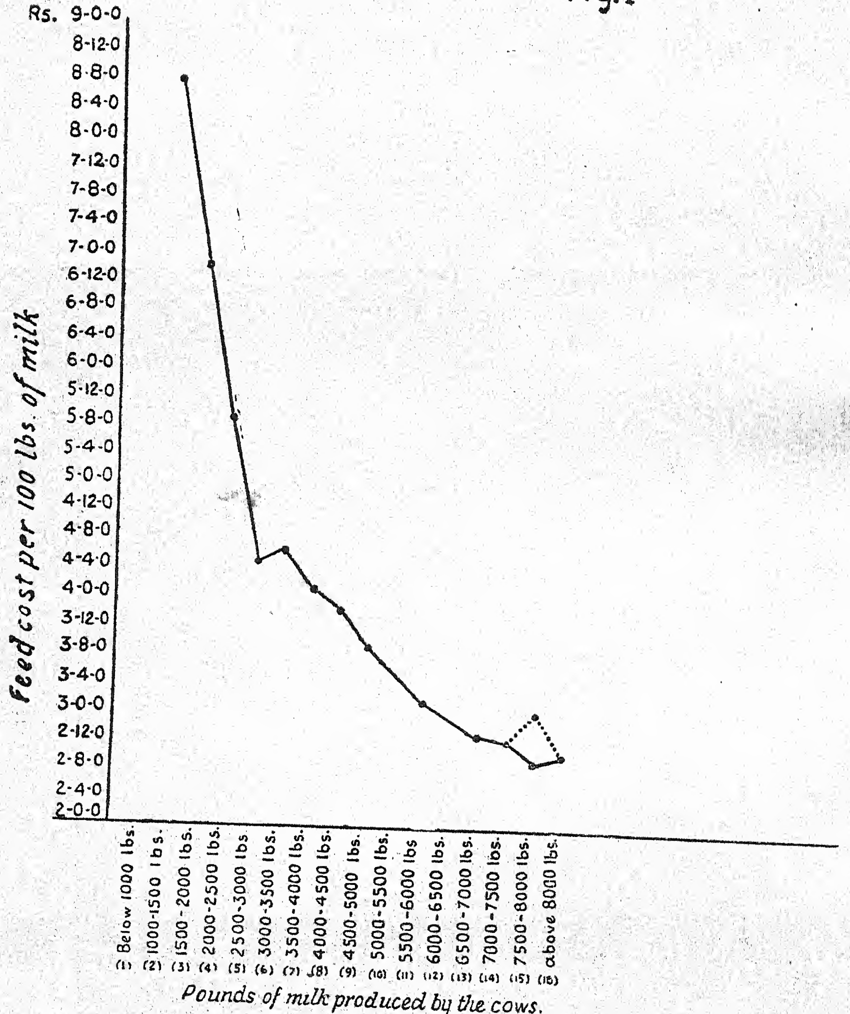
Except for 11 heifers which came in milk during the course of the year, all other animals have completed one full year in the herd. As this paper chiefly concerns itself with the feed cost in relation to the productivity of cows, we have used the Danish method of herd averages for these 11 heifers. The Danish method bases its herd averages on the basis of the 365 feeding days. These 11 heifers had altogether 2,081 feeding days, that is, there were 5·7 cows feeding for 365 days each. The feed cost, production average, and income are all calculated on this basis of average cows.

The records were sorted and grouped according to the production of milk from individual cows.

Figure I shows the relation between milk production and feed cost per 100 lb. of milk. As milk production increased from groups 1 to 16, the feed cost per 100 lb. of milk decreased. Though the decrease from groups 1 to 5 is very rapid, from groups 5 to 13 the decrease is accelerated, while after group 13 the decrease is very slow. In group 15 the black line is for a normal cow covering the whole fiscal year in the herd. The dotted

line is for the average of those 11 heifers mentioned above. It shows a distinct upward curve. This is due to taking the average on the 365 feeding days' basis. Now, though we practically double the cost of feed, the milk production is not doubled, but is something more than double; or, in other words, if we double the production, the feed cost would not increase in the same proportion, but it would be less, as in the case of the normal cow shown with the black line.

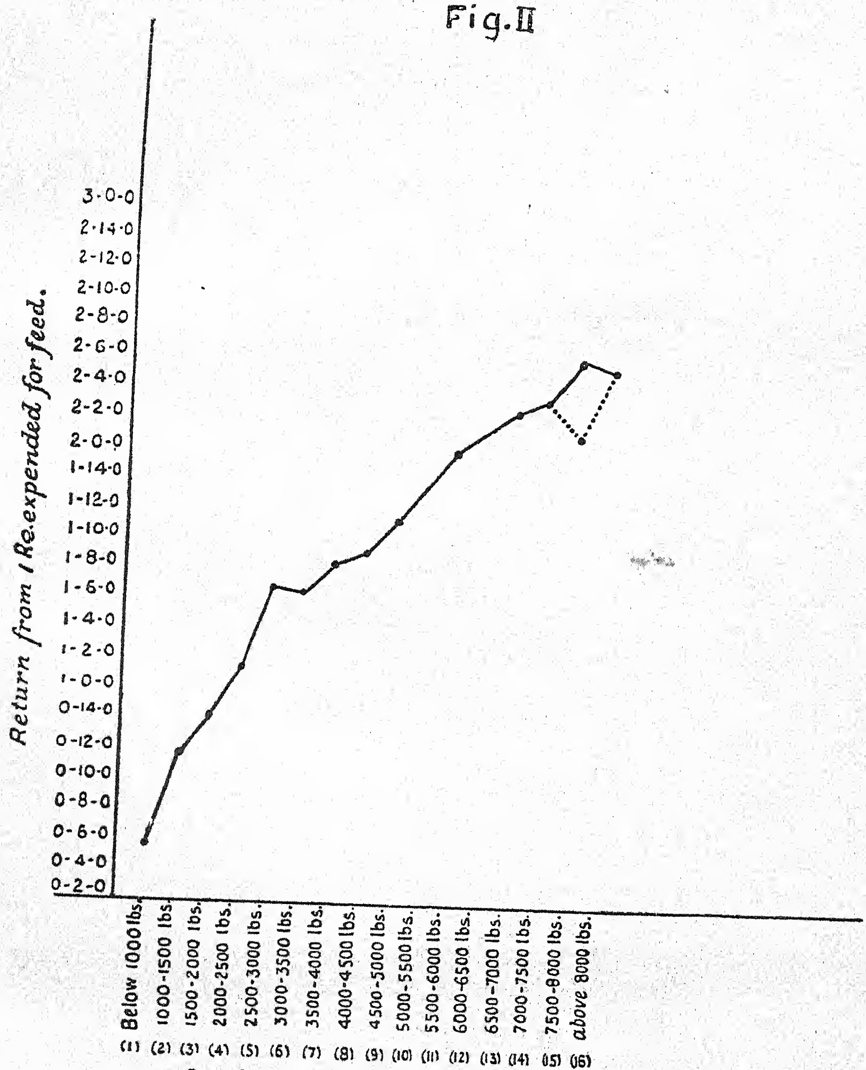
Fig. I



Relation between milk production and feed cost per 100 lbs. of milk.

Figure II shows the relation between the milk production and the income from Re. 1 worth feed expenditure. From groups 1 to 3 we find that the income is much smaller than the expenditure. This shows that, on the cost of feed basis alone, a cow producing below 2,000 lb. of milk a year would be a losing proposition. As milk production increases, we find that the income from Re. 1 spent on feed is also proportionately increased. For a cow producing above 8,000 lb. of milk per lactation the return is practically Rs. 2-5-4 per rupee spent on feed, or about 235·0 per cent.

Fig. II



Relation between milk production and return from 1 Re. expended for feed.

FERTILIZERS FOR PADDY

By J. Mackay

At the time when this number of the *Allahabad Farmer* is published cultivators in the United Provinces will be busy with their paddy crops. The United Provinces grows about 6½ million acres of paddy, and it is therefore one of the most important crops in the provinces.

Cultivators do not pay as much attention to the improvement of the yield of this crop as they do to others; although, with very little effort, good results can be obtained. It is well known that the yield of crops depends in a large measure on the development of roots. It has been thought that rice could develop different types of roots according to conditions, those grown in a dry soil developing roots according to conditions, those grown in a dry soil developing roots comparable to our common grain roots, and those grown in a muddy soil comparable to the roots of swamp soils. A careful examination of paddy roots of different types has shown, however, that they do not resemble those of typical aquatic plants, but are similar to those of ordinary dry-land crops. By the improvement of aeration, tilling operations, and drainage, and by proper manuring, the root development in dry-land plants has been assisted. Of these factors, the last is most important in the case of rice. Apart from all other considerations of manurial value, or influence on the texture of the soil, one of the most important functions of green manuring with reference to paddy soils lies in promoting the activity of the surface film, which is responsible for the proper aeration of the roots. Green manuring is therefore of the greatest value, and should certainly receive much more attention than is now given to it. Though green manuring is of the utmost value to the crop, it is not in itself sufficient to produce the best results. This can be obtained by combining with the practice of green manuring the application of artifical fertilizers.

Experiments in all the chief rice-growing countries have proved that a fertilizer of the ammonium phosphate type such as nicifos produces the best results on paddy. Phosphates, in addition to promoting good root growth, thus preventing the root diseases which are so common, has also been found to stimulate the assimilation of nitrogen, which would otherwise not be fully utilized. The use of this kind of fertilizer is of immense value in the nurseries since the seedlings show a much larger development of the root system, and are able to withstand disease and produce the best results. Since nitrogen is best supplied to the paddy crop in the shape of ammonia, the use of nicifos,

(*Continued on page* 191)

FARM CARTS WITH PNEUMATIC TYRES

By H. K. Mukerjee

The search for a farm cart with a low initial starting and moving pull has been engaging the attention of the Engineering Department of the Allahabad Agricultural Institute for a fairly long time. That penumatic-tyred wheels with roller-bearing hubs mounted on a suitable axle would be *the* solution has already occurred to the department; but, due to the difficulty of obtaining a suitable assembly in India, the practical trial of the idea had to be deferred. The head of the department, however, had been on the look out when about midwinter of 1932 an an English agricultural engineering monthly discussed in detail and advertised pneumatic tyres developed and applied to farm carts by the Dunlop Rubber Co., Ltd., Birmingham. Our desire to experiment with this new application of pneumatic tyres under Indian conditions was made known to the Dunlop people at Calcutta. They readily agreed to supply us with a pair of wheels, axles, and bearings. While the Dunlop people were corresponding with their head office in England, we began the design of the cart.

Experience with a number of all-steel and wooden carts on the farm had shown us that, in spite of its intitial high cost, the steel cart scored over the latter in the long run. An all-steel cart with a suitable removable wooden framework for carrying loads like bhusa, fodder, wheat, barley, gram, and arhar after harvest, and a low loading platform, were therefore decided upon.

Plans were prepared, and an all-electrically welded iron framework of the cart was constructed. The shaft of the cart is a built-up one like the jib of a crane, being broad at the cart end, and tapering to about 8″ at the yoke end. It is built up of four pieces of $1\frac{1}{2}'' \times 1\frac{1}{2}'' \times \frac{1}{4}''$ angles braced with flat iron. This has cut down the weight of the shaft, made attachment to the cart frame simple, has distributed the strain on the cross-members on the cart frame to which it is attached, and has added a lot to the appearance of the cart. The Dunlop Rubber Co. recommended a load of 5,000 lb. on the tyres, with an air pressure of 40 lb., which may be increased to 70 cwt. by increasing the pressure to 60 lb. in the tyres. To put the cart under a severe test, the trial run was made with a load of 900 bricks, each brick weighing $7\frac{1}{2}$ lb., which is 6,750 lb., *i.e.*, an overload of 35 per cent at the low pressure on a rutted macadam road. The speed at which it went on level roads pulled by a pair of good-sized bullocks was $2\frac{1}{4}$ miles per hour, and up a gradient of 1 in 25 feet at $1\frac{1}{3}$rd miles per hour.

Due to the slow speed and the special design of the outer cover, the risk of punctures is negligible; and the roller-bearing

hubs are packed with grease to last for at least six months. The cart has been running for a month now with the same load, with the only attention of checking the air pressure every second or third day. Besides advantages like smooth running on all surfaces, leaving no aftermath of ruts and ridges, damage to grassland, and danger of damaging the roots or vegetables over which the wheels may pass, it needs only two bullocks to haul a load equal to, or more than, a desi cart.

The cost of this cart will be—

	Rs.	a.	p.
Cart complete	350	0	0
Two bullocks, at Rs. 75 each ...	150	0	0
Total Rs. ...	500	0	0

The biggest size desi cart can carry a load of 6,720 lb., but, due to very few cartmen being able to afford three good-sized, powerful bullocks, the haulage varies from 3,360 lb. to 5,600 lb. In all cases, the number of bullocks needed is three.

A desi cart hauling 6,720 lb. load cost—

	Rs.	a.	p.
Cart frame, wheels, and axles ...	200	0	0
Three bullocks, at Rs. 75 each ...	225	0	0
Total Rs. ...	425	0	0

It does not finish here. After a pair of wheels is put into use for about 5 or 6 months, the cartman has to take his cart to a carpenter every month to shave off the "tal," which is the spreading out of the fibre of the wood on the sides of the wheels due to its being without tyres. This costs him Rs. 6. After the sixth month, iron tyres are put on at a cost of Rs. 15. This brings up the investment to Rs. 425, plus Rs. 21 = Rs. 446. Let us take the next size of desi carts that haul as much as 5,000 lb. only—

	Rs.	a.	p.
Axles, wheels, and cart frame ...	100	0	0
Three bullocks, at Rs. 50 each ...	150	0	0
Total Rs. ...	250	0	0
Cost of "tal" and tyre ...	21	0	0
Total Rs. ...	271	0	0

In this type of cart, the material and workmanship are generally of a low grade; hence the maintenance cost is high.

The life of this cart seldom goes beyond $2\frac{1}{2}$ years. The life of a pair of pneumatic tyres is expected to be about the same. The life of the tyres can be increased by careful attention to pressure, and by shading them from the sun with an old bag when not in use. A replacement of the tyres and tubes may be made at the end of that period for about Rs. 75, and the cart is practically new again. The iron frame of the cart, barring accident, is good for 15 years at least. The desi cart, at the end of $2\frac{1}{2}$ years, when replaced with a pair of new wheels, is still not so good an outfit as the pneumatic-tyred one.

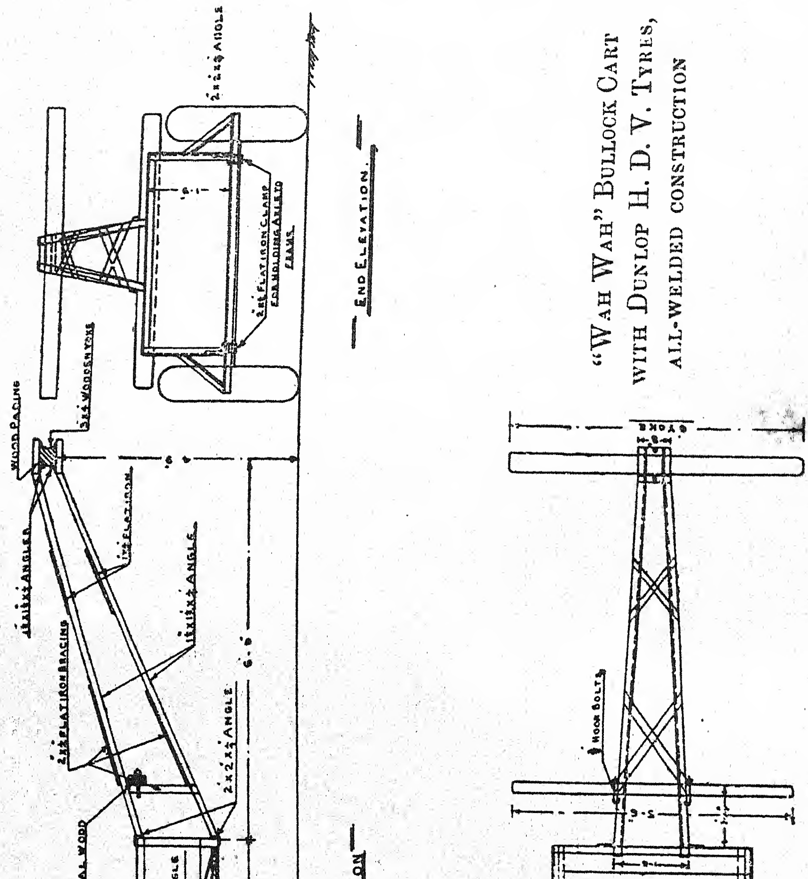
The cost of feeding a bullock is about 8 annas a day. The desi cart with three bullocks costs Re. 1-8 per day. The pneumatic-tyred one with two bullocks costs Re. 1 only. The saving is 8 annas a day, or Rs. 15 a month or Rs. 180 a year. Now then, in about one year and four months' time, the saving effected by feeding two bullocks, instead of three, would pay for the extra money needed (Rs. 500—271 = Rs. 229) to buy a pneumatic-tyred cart. If the life of pneumatic tyres were only $2\frac{1}{2}$ years, even then it would be a profitable investment because of the saving of Rs.—45) the cost of feeding a bullock for $2\frac{1}{2}$ years.

(Continued from page 180)

which contains 18 per cent N and 18 per cent P_2O_5, or sulphate of ammonia, can be strongly recommended. These fertilizers are not easily washed out, but are fixed in the soil and become gradually available.

Experiments in the United Provinces and elsewhere have proved that the application of fertilizers in the seed-bed makes the seedlings ready for transplanting much earlier than the normal. About 3 seers of nicifos II mixed with three times the quantity of earth are generally spread over a biswa of land, and then the seeds are sown to prepare the best nursery. When the field is ready to be transplanted, about 2 inches of water are generally left in the field and 150 lb. of nicifos II, or 200 lb. of sulphate of ammonia, per acre are broadcast. Then the seedlings are transplanted. Where rice is broadcasted and weeded later, the application of the fertilizer immediately after weeding appears to be the best practice to recommend. The application of the fertilizer in water more than 3 or 4 inches deep is not to be recommended, and thorough incorporation of the fertilizer with the soil is essential if losses are to be avoided or kept within reasonable limits.

Do you know what milk did for 41 boys?
If not, send for our leaflet.



"WAH WAH" BULLOCK CART
WITH DUNLOP H. D. V. TYRES,
ALL-WELDED CONSTRUCTION

THIRD ANNUAL FARMERS' FAIR AT THE ALLAHABAD AGRICULTURAL INSTITUTE

That the annual Farmers' Fair at the Allahabad Agricultural Institute is making a growing appeal was evidenced by the large number of villagers who attended the third annual Fair during its running on March 8, 9, 10, and 11. There was a drop in the attendance of the educated community this year, but this is not regarded with apprehension because the primary aim of the Fair is to reach the uneducated and unprivileged classes of the crowded Allahabad district. The whole emphasis of the programme this year was laid on "Better Living," and it was designed to open up to the villager paths of more or less immediate progress in material and social welfare.

A prominent Indian, Munshi Iswar Saran, who addressed the Fair on the closing night, was sceptical about taking part in the function because he felt that the Institute was using it as a cloak for religious propaganda. It was explained to him that the mission enterprise was here to spread the Gospel of Christ, and that on this particular occasion an entirely separate evangelistic campaign was being carried on. Such functions as the Fair, he was told, were considered also to be an important part of the mission's programme, and the Fair itself was not concerned with the dissemination of religious teaching. He agreed to speak following this frank statement, and in the closing words of his address he paid a tribute to those responsible for the Fair. Said he: "Although I do not agree with some of the religious views of this group, I cannot help praising this institution and those connected with it for the splendid work they are doing."

An encouraging aspect of the Fair was the interest shown by public leaders in taking part in the programme. Dr. Ganganath Jha, former Vice-Chancellor of Allahabad University, Dr. Narayan Prasad Asthana, Advocate of the High Court and former Vice-Chancellor of Agra University, Dr. Tara Chand, Principal of the local Kayastha Pathshala Intermediate College, Munshi Iswar Saran, prominent civic leader, and Rai Sahib Hari Ram Singh, former general propagandist for the Co-operative Department of the United Provinces Government, gave addresses at the evening meetings of the Fair. In all cases their message was intended for the villager.

The daily programme commenced with exhibitions and demonstrations in the morning. Following a recess in the heat of the day, the displays were opened again in the afternoon, and in the evening a principal address was made followed by motion pictures. On two evenings a play was given by students of the Institute.

When the evening programmes began, the attendance was unusually small, but as the shadows lengthened and the villagers returned from work a large area in front and on the sides of the speaker's platform became filled with a mass of ignorant and curious humanity. The large number of little village children who attended is an encouraging sign. Though they probably got very little of what the speaker said, their impressionable minds took in easily the motion pictures on health and sanitation loaned to the Institute by the Indian Red Cross Society. They also enjoyed the plays which were staged by some of the students.

An interesting account of the opening day of the Fair appeared in the columns of the *Pioneer*, one of the best-known daily newspapers in India. The report said:

"In keeping with the tradition of this important Fair, the students and staff of the Institute did not spare themselves in making the exhibition an unqualified success. The neighbouring villagers had been informed of the exhibition by the beat of drums, and hundreds of them, both men and women, turned up at the end of the day's work to hear Dr. Tara Chand's lecture on 'Village Social Service.'

"The exhibits were artistically arranged in the spacious hall of the Institute. The giant cabbages, English peas, papayas of staggering weight and size—all grown on the college farm—were examined with amazement by hundreds of visitors. The horticultural section, where jellies, pickles, and other condiments were being prepared by the students from fruits grown in the college orchard, was patronized especially by women and children.

"The maternity and children's welfare section, arranged by Dr. Hayes, deserves special mention. Model cots complete with mosquito curtains and celluloid babies made the well-ventilated room look like an ideal nursery. Vernacular posters hung over the walls explained in simple language to the curious villagers how to look after their wives and children.

"Behind the Institute building arrangements have been made to teach the villagers the elementary principles of sanitation. It is beyond dispute that, if the septic-tank system and another form of drainage favoured by the Institute authorities are adopted in the villages, not only will the soil be enriched, but the toll of cholera and many infectious diseases will be considerably curtailed.

"The modern agricultural implements, which have placed the Institute farm on such a high level of efficiency, make the antiquated *desi* (country) ploughs look like toys. The seed drill, the mower, and the reaper give the lie direct to the statement that Indian soil is poorer than Canadian or American soil. The soil is

the same; the difference lies in the methods of cultivation. For the benefit of the poor cultivators who cannot afford to buy the modestly-priced modern plough, Mr. Vaugh, the Institute's Engineer, has invented improved *desi* ploughs."

Among the interesting exhibits were a model village, made by students; some poultry, loaned by the United Provinces Poultry Association; a practical demonstration of the absorption capacity of various kinds of soils, with notes on which soils were best suited for growing certain crops; grafting and budding; the use of a garden-sprayer, extensively employed in tea gardens; and different kinds of lift pumps and power engines. Practical demonstrations of farm implements with bullocks were also given.

Two of the speakers assailed some of the evil and wasteful practices of villagers, while one, Munshi Iswar Saran, decried the lack of interest shown by educated Indians in the welfare of their less fortunate countrymen in the rural districts. Dr. Asthana said that division and strife are potent factors in village life which disrupt and make impossible co-operative progress in the ordinary village community. The prevalence of factions, he said, and the lack of harmony, rendered co-operative enterprises impossible and militated against the successful working of the panchayat (village council). "The reason for so much wasteful litigation," he added, "is that there are relatively few good *panchayats.* Villagers take the smallest quarrels as far as the High Court, and such things breed in them the hope of getting an unfair reward and a strong gambling spirit."

Rai Sahib Hari Ram Singh spoke against the reckless spending of money on marriage ceremonies, the singing of obscene songs, the harmful influences of early marriage, untouchability, and the waste of useless litigation.

Munshi Iswar Saran said: "There can be no gainsaying the fact that India is destined to be an agricultural country for many years to come; and, if agricultural methods are to be even a little improved, vocational education is imperative. The chief responsibility for village improvement, however, lies on the shoulders of the educated, who owe a vast debt to the so-called lower classes. Much unemployment among the middle classes and university graduates is due to the fact that these people are unwilling to go back and work on the land."

This year's Farmers' Fair has been admittedly the best ever. Encouraged by the increasing interest of the public, the Institute plans to hold an even better exhibition next year. One of the features of the next Fair will be the offering of prizes for the best agricultural produce brought in and displayed by villagers. In this way it is hoped that they will not only take a greater

interest in the Fair, but will be spurred on by the spirit of competition to arouse themselves from their age-old inertia and seek to grow better crops. The wives of men who are very strict in their ideas of keeping purdah were noticed at some of the evening meetings. By making a growing appeal to women also it is hoped that the Fair will help to make purdah a thing of the past in this district.

"We *are* brothers in a common quest, and the first step is to recognize it, and disarm ourselves of our prejudices."

"Though the world is a world of law, the supreme law of the world is not physical but moral."

"Be not the first by whom the new is tried, nor the last by whom the old is laid aside."

What is to be done

With these guilty central schools? Dr. D. Spencer Hatch, in his recent book, "Up from Poverty," says—

"The especially favoured boy in the Indian village, who goes on to high school and to the distant college, never comes back to live and work in the village......the village cannot support him in the way in which he has learned to live, and cannot pay him what he can command elsewhere. Through his good fortune the village has lost another of its few leaders."

Adult Education

Which is being fostered so much nowadays should prove a boon for people in rural areas. There is under way a significant movement in China, but in India it has not risen to the dignity of a movement. With the adult boy and girl, man and woman in mind, there should be more experimentation and co-operation. Some of the finest features of this work are the short-term courses of four or six weeks given to select village men and women during the time of the year when they have no work in the fields *(Katpadi Rural Reconstruction Centre)*.

"In any village advance *the woman is the key!*"

"Caste is the expression of stagnation."

"Rural leadership imbued with the spirit of service is fundamental to widespread progress in rural reconstruction."

The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

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The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE
AND RURAL LIFE

Vol. VII] SEPTEMBER, 1933 [No. 5

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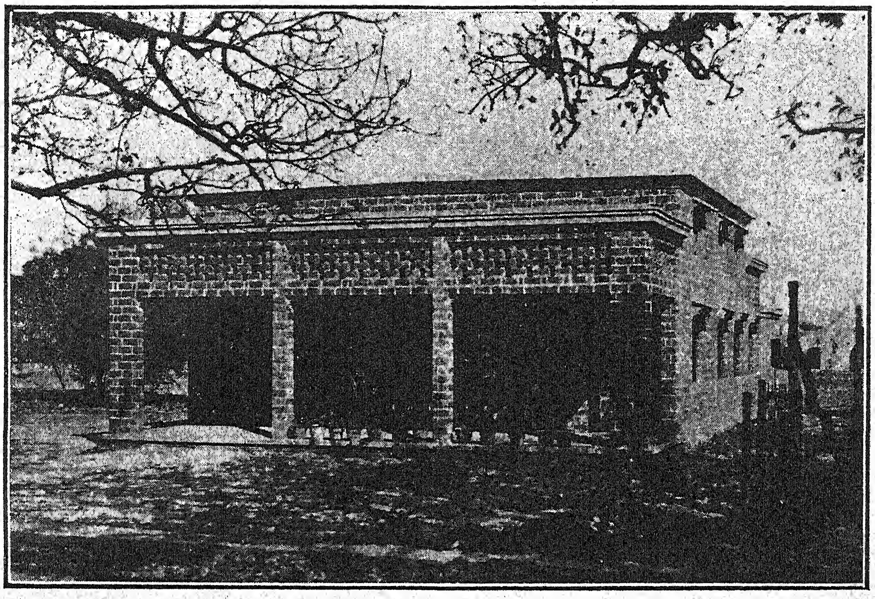
MODEL QUARTERS



The most recently completed staff quarters built at the Agricultural Institute is an attempt to provide comfortably for the small family on a salary of Rs. 100-200, when annual rent is to be approximately 5 per cent of the cost of building and about 10 per cent of medium salary.

It provides a study, sitting-room, 2 rooms for use of the family, kitchen, store, and 2 verandahs. In the corner of the courtyard a bath-room and flush latrine, connected to a septic tank just outside, are provided.

These quarters are pakka throughout, not even mud mortar being used at any point. Cement floors are made as described in Vol. VI, No. 4, October, 1932, of "The Allahabad Farmer."

It is anticipated that it will be white ant proof. Closets and cupboards for clothing, books, and supplies are built in, at least one in every room.

The cost was Rs. 3,500 for the building only (nothing for land), including sanitary arrangements, electric wiring, and water in bath, latrine, and kitchen.

Blue prints can be supplied at Rs. 3 each by addressing the Agricultural Engineer.

THE
ALLAHABAD FARMER

Vol. VII] SEPTEMBER, 1933 [No. 5

EDITORIAL

Agriculture v. Dairying.

In an endeavour to popularize, develop, and extend Dairying and Animal Husbandry in India, the Imperial Council of Agricultural Research has attached to it the Imperial Animal Husbandry Expert, and the Imperial Department of Agriculture has for its spokesman, the Imperial Dairy Expert. A few provinces show some interest in dairying and animal husbandry in that they employ special officers to cover the field, who are called Assistant Directors, Live Stock Experts, etc.

In attempting to focus *the attention of Governments* on the necessity of considering the development of dairying more seriously in the future than in the past, the Animal Husbandry Expert to the Imperial Council of Agricultural Research, New Delhi, has compiled statistics, which speak for themselves.

Some of the outstanding statements made are quoted in the following paragraphs. Our editorial comment will follow in a later number:—

"The gross value of live stock to India is greater than that of arable crops.

"The annual cash value of animal products in India amounts to about 1,900 crores of rupees per annum.

"The value of live stock products in India—

		(In crores of Rs.)
1.	Cattle labour in agriculture	612·0
2.	Labour for purposes other than agriculture	161·0
3.	Dairy products	810·0
4.	Manures	270·0
5.	Other products	45·20
6.	Living animals exported	0·36
	Total Rs. ..	1,898·56 crores.

"The amounts expended on live stock improvement work from the budget of provincial departments (1930-31, revised)—

Provinces	Total Expenditure by Provincial Departments of Agriculture	Expenditure from Agricultural Department Funds *on Cattle Breeding*	Percentage
	(In lakhs of Rs.	(In lakhs of Rs.)	
Madras	20·3	2·1	10·3
Bombay	17·9	1·5	8·4
United Provinces	23 3	1·9	8·1
Assam	5·2	0·4	7·9
Central Provinces . ..	11·2	0 9	8·0
Total Rs. ..	77·9	6·8	8·7

In the above five provinces out of a total of 77·9 lakhs of rupees of expenditure by the provincial Governments, *only* 6·8 lakhs of rupees were spent *on cattle breeding and the dairy industry*, regardless of the fact that the gross value of live stock exceeds that of the arable crops. It is time the emphasis was changed.

"*There are about* 1,750 *officers in the provincial veterinary services, all specially trained and experienced in live stock matters, but the great majority are not utilized at all in connection with provincial live stock improvement measures.*"

At least one-half of the total funds available for the development of agriculture as a whole in the provinces *should be* devoted to the dairy and animal industry.

* * * *

Absentee Landlords.

Times have changed, are changing now, and will change more in the future!

Notwithstanding that many zamindars trace their heredity back to ancient rulers, and have acquired a unique position in the economic development of India, nevertheless the general prevailing opinion is that they function primarily as "*absentee landlords.*"

"Absentee landlords" are not to be criticized as such in this note, but should be warned of the dangers of such a practice in these turbulent days.

There is a golden opportunity that needs to be grasped, and a real need for landlords to leave their palatial city and suburban residences and move to village environments where they can get in touch with their tenants, and in a real sense become "*gentleman farmers.*"

* * * *

Trends of Agricultural Improvement.

In spite of (or it may be as a result of) the agricultural depression which during the past few years has rendered so unenviable the lot of the cultivator in India, as in other countries, *there has been of late a considerable improvement in agricultural practice in the United Provinces.* This improvement is be seen particularly in three directions: the appreciation and use of the improved varieties of seed now obtainable as a result of the labours of the Department of Agriculture; the slow, but steady, replacement of the comparatively inefficient desi plough by new types which open up the soil more satisfactorily; and in the increasing attention paid to the manuring of the crops with both organic and inorganic fertilizers.

* * * *

Manuring.

By none have the advantages of proper manuring been more thoroughly appreciated than by the *vegetable growers* in these provinces. Vegetables are grown on a large and increasing area in the United Provinces, the latest crop reports showing that the area under potatoes is now no less than 115,000 acres, and that under fruits and vegetables other than potatoes 397,000 acres. Potatoes and vegetables are crops which give the cultivator a good return, and which have the big advantage of not keeping his capital tied up in the land for long periods as they are crops which mature quickly and are readily saleable. In all parts of the provinces where potatoes and vegetables are grown on a large scale, organic and inorganic fertilizers are now being used in increasing quantities. *Green manuring* is an increasing practice where the land can be spared for sufficient time to enable the green manure crop to be grown, while oil-cakes, farm-yard manures, and municipal refuse are extensively used in places where they can be obtained cheaply and close to the places where they are to be consumed; but these fertilizers are bulky and have a comparatively low fertilizer content, and it is not therefore usually a paying proposition to carry them for long distances.

Most Popular Inorganic Fertilizers.

Furthermore, *the available supplies are not nearly sufficient for the manurial requirements of the provinces*, and they have to be supplemented by the concentrated inorganic fertilizers of which the most effective and the most popular in these provinces are *sulphate of ammonia*, which contains 20·6 per cent nitrogen, and *Nicifos II*, which contains 18 per cent nitrogen and 18 per cent phosphoric acid. These fertilizers, especially when applied to soil which has already received a good dressing of organic fertilizers, have given striking results, and the extent to which they are now being used in the potato and vegetable-growing areas of these provinces proves that the cultivators are entirely satisfied with the results which they are obtaining from them. Cultivators have found that *for potatoes* the best results are obtained by spreading 2 maunds of sulphate of ammonia and 2 maunds of Nicifos II per acre over the ground when it has been prepared for sowing the seed and before making the ridges on which the seeds are sown. Where cheapness is a decisive factor, good results have also been obtained by omitting the Nicifos, which is the more expensive of the two fertilizers, and applying 4 maunds of sulphate of ammonia only per acre. *For vegetables* it has been found better to apply the fertilizers in two doses, 2 maunds of Nicifos or sulphate of ammonia per acre being applied at the time of sowing the seed and a further 2 maunds of sulphate of ammonia being applied as a top dressing when the plants are 4 to 5 inches high and when they are about to be watered. These fertilizers have the added advantage of being easily obtainable by the cultivators as stocks are held in all the principal towns of the provinces, as well as in many of the villages in the principal consuming centres.

* * * *

The Wah-Wah Plough.

The Wah-Wah plough continues to win favour and users. One was sent for exhibition to the All-India Swadeshi Exhibition at Ujjain. It won both a silver medal and a first-class certificate of merit—the highest prizes awarded. Better than medals and prizes, it is being bought in increasing numbers for actual use.

* * * *

The Wah-Wah Cart.

The steel bullock-cart described in the last issue of the *Farmer*, equipped with Dunlop B. D. V. pneumatic tyres, has given excellent results in practical service. It was put to hauling bricks from the brick-yard to the city, about 3 miles' distance. In 46 days 66,094 bricks were

delivered. Only two bullocks were used, and they were rather old, and not strong. The haul was across the Jamna bridge, which is restricted to one-way traffic for bullock-carts and thelas. This made it impossible to haul more than three loads in two days. Had there been no delay due to the bridge, it is estimated that full two loads a day, with a resulting increase in the number of bricks and the profit, would have been possible.

This test was discontinued in order to use the cart for moving a travelling agricultural exhibition on a tour of villages in the Allahabad District. This tour occupied a period of three weeks, and was largely on katchcha roads. Due to the early commencement of the rains, it was thoroughly tried out not only on pakka roads, but on katchcha as well. Two small bullocks and a buffalo were available for power. They had proved inadequate for the previously-used desi cart; and a larger pair had been purchased, but not delivered. During the whole tour it was never necessary to use more than two of the three animals on the "Wah-Wah" cart. The only time the cart was stuck during the trip was on a hot day, when the buffalo decided to have a bath in a canal and take the cart with him. The cart completed the tour with the same air taken from Allahabad, it not having been necessary to add any during the three-weeks' period.

* * * *

The Borehole Latrine at Rs. 30.

The Borehole latrine has made a wide appeal since it was given publicity in our January number and through Dr. Hatch's article in the March issue of the *Allahabad Farmer*. There have been many calls for further information and orders for the borer for making the holes. These borers are being supplied by the *Agricultural Engineering Department* of the Institute at Rs. 30 each, which puts them in reach of many people. In June and July three borers have been supplied, and orders are in hand for several others.

A method of making seats of the pattern recommended by the Rockefeller Foundation, without the use of expensive forms or of concrete, has been worked out. A square place 2′6″ square is levelled and sloped to the centre so the centre is 1½″ lower than the edges. Bricks flat are spread out on the prepared surface in even rows. Two iron rods are put in the joints in each direction and the bricks are cemented together with a mortar of 1 part cement to 3 parts sand. Kadamchis, or foot-rests, are added of brick, and the whole is plastered over with cement mortar. Treating with sodium silicate is desirable, but not essential. It should

be kept wet for a week or ten days, after which it may be put in place on the borehole.

The Borehole latrine is a necessity for every village. Place your order now!

* * * *

The Pyinmana Agricultural School.

In the course of ten years, out of 381 students who have enrolled, 182 have completed a two-year course, and 90 have completed a four-year course and graduated.

Of the graduates of the 2-and 4-year courses, 59 per cent have gone back to their villages to do agricultural work with their own hands, and a total of 90 per cent have taken up some form of work directly serving the villages. Only 5·7 percent went into Government service, and 16·7 per cent into agricultural mission work.

The opinion is frequently current that education, and especially higher education, divorces the youth from his village. There are of course some notable exceptions to this arbitrary rule, and "Pyinmana" is one of them. We are heartily in sympathy with the aims and objects of such institutions that can educate their youth and instil in their minds and hearts a sincere love for service in their home communities.

* * * *

Government Recognition of the Need for Agricultural Training.

"The Ministry of Education of the National Government recently passed a regulation stating that, beginning in the fall of 1933, the number of students admitted to courses in Arts, Law, Education, and Fine Arts should not exceed the number admitted to Science, Medicine, Engineering, and Agriculture. At present about 70 per cent of the students in China are in the former group, and 30 per cent in the latter. The fact that the National Government of China has recognized the need for trained agriculturists, and has put this on a par with the need for scientists, doctors, and engineers, promises well for the future of rural China."—

Agriculture and Forestry Notes, University of Nanking, China.

Broadcasting.

During the past decade numerous innovations in various countries have passed through the experimental stage and are now here to stay—the most notable of which are aviation, civil and commercial, and broadcasting.

Few civilized countries are to-day without their own broadcasts. In India progress has been disappointing; but, with the renewed interest and support of broadcasting being shown in the current Press, the sign is hopeful that something may be done to augment the beginning already made.

It is well known that the Indian Broadcasting Company began operations in 1927, and, due to failure, Government took over the Calcutta and Bombay broadcasting stations in 1930.

There is a need for developing these stations in the direction of *national programmes* that will meet the need of outlying districts. Among the obstacles to such development are the poverty and poor standard of education of the masses and the multiplicity of languages and dialects. In view of these obstacles, very little can be hoped for in the way of a national programme to reach the outlying masses from the central Calcutta and Bombay stations.

At present emphasis must be placed upon provincial broadcasting, and probably to a greater extent upon district broadcasting, to meet a certain language area need.

A number of universities in India have for some years been granted an *experimental licence* by Government. Has the time not come when some of them may well become regular broadcasting centres?

The Simon Report is cited in support of the view that the present system of elementary education in India has distinct limitations; and it is pointed out that, "when a child leaves school (often after merely vegetating for a few years in the lower classes and only securing the most rudimentary grasp of the elements of literacy), all stimulus to mental activity and development is removed." This state of affairs, together with the isolated position of the villager from outside affairs, would, it is contended, be remedied to some extent by suitably-planned programmes.

Broadcasting, with "collective listening" through the aid of loud speakers erected in public places, has already been successfully employed in Madras. It now remains for other large cities and centres to extend the idea further. Government should encourage and assist private individuals and institutions to utilize "broadcasting" methods in rural reconstruction efforts.

Cross-breeding in the Philippines.

The April-May number of the *Bureau of Animal Industry Gazette*, Philippines, contains, in its miscellaneous section, a brief account of their attempt to cross Brown Swiss and Nellore cattle.

Out of six Brown Swiss bulls imported into the Philippines prior to 1931, two are left; two having been sold by Government to private breeders, and two having died of an unknown disease.

To-day there are approximately 226 Brown Swiss-Indian grade cattle in the islands. They are range cattle. In general appearance, colour, size, and conformation these grades resemble their dams rather than their sires. In other words, the Indian Nellore heredity seems dominant. They are a slight improvement over the Indian grade cows.

* * * *

War Resisters' International.*

Two years ago Professor Albert Einstein, the world's most celebrated scientist and a man who is often said to possess the world's greatest mind, addressed the War Resisters' International in Lyon, France:

"I address myself to you, the delegates of the War Resisters' International meeting in conference at Lyon, because you represent the movement most certain to end war. If you act wisely and courageously, you can become the most effective body of men and women in the greatest of all human endeavours. Those you represent in fifty-six countries have a potential power far mightier than the sword.

"All the nations of the world are talking about disarmament. You must lead them to do more than talk. The people must take this matter out of the hands of statesmen and diplomats. They must grip it in their own hands.

"Those who think that the danger of war is past are living in a fool's paradise. We have to face to-day a militarism far more powerful destructive than the militarism which brought the disaster of the great war.

"This is the achievement of Governments. But among the peoples the idea of war resistance spreads. You must challengingly and fearlessly extend this idea. You must lead the people to take disarmament into their own hands, and to declare that they will take no part or lot in war or in the preparation for war. You must call upon the workers of all countries unitedly to refuse to become the tools of death-dealing interests. There are young

**The Fellowship*, July, 1933: Methodist Publishing House, Lucknow.

men in twelve countries who are resisting conscription by refusal to do military service. They are the pioneers of a warless world. Every sincere friend of peace must support them and help to arouse the moral conviction of the world against conscription.

"I appeal especially to the intellectuals of the world. I appeal to my fellow-scientists to refuse to co-operate in research for war purposes. I appeal to the preachers to seek truth and renounce national prejudices. I appeal to the men of letters to declare themselves unequivocally.

"I ask every newspaper which prides itself on supporting peace to encourage the peoples to refuse war service. I ask editors to challenge men of eminence and of influence by asking them bluntly: 'where do you stand? Must you wait for everyone else to disarm before you put down your weapons and hold out the hand of friendship?'

"This is no time for temporizing. You are either for war or against war. If you are for war, you must encourage science, finance, industry, religion, and labour to exert their power to make your national armaments as efficient and deadly as they can be made. If you are against war, you must encourage them to resist it to the uttermost. *I ask every one who reads these words to make this great and definite decision.*

"Let this generation take the greatest step forward ever made in the life of man. Let it contribute to those who follow the inestimable gift of a world in which the barbarity of war has been for ever renounced. We can do it if we will. It requires only that all who hate war shall have the courage to say that they will not have war.

"I appeal to all men and women, whether they be eminent or humble, to declare before the World Disarmament Conference which meets at Geneva in February that they will refuse to give any further assistance to war or the preparation for war. I ask them to tell their Governments this in writing, and to register their decision by informing me that they have done so.

"I shall expect to have thousands of responses to this appeal. They should be addressed to me at the Headquarters of the War Resisters' International, 11, Abbey Road, Enfield, Middlesex, England. To enable this great effort to be carried through effectively, I have authorized the establishment of the 'Einstein War Resisters' International Fund.' Contributions to this fund should be sent to the Treasurer of the W.R.I., 11, Abbey Road, Enfield, Middlesex, England.

(SIGNED) A. EINSTEIN.

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THE CO-OPERATIVE MOVEMENT

In the July number of *The Allahabad Farmer* we drew attention to the remarkable growth that had taken place in the co-operative development of industry during the past hundred years from a meagre beginning to a movement now comprising 60,000,000 *members and* 200,000 *co-operative societies* of 40 *countries* federated in the International Co-operative Alliance.

In this present article we shall trace briefly the organized development of the movement in the country in which it originated.

It was in Rochdale (England) in 1843 that the movement actually began.

At that time there was *a financial crisis;* a little group of mill-hands and miners sat discussing the dark outlook. They were troubled by the unemployment situation and their debts to the stores, with little chance of paying them. They discussed all kinds of possible ways out of the morass of despondency that they were in. (The same situations have recurred in many countries since those days with what we think a final culmination of financial stringency that is now facing the major portion of the world.)

The idea that took hold among that lot of miners and mill-hands was the idea of a co-operative store—a store which should be owned and operated by those who patronized it; a store which therefore would be operated for the benefit of the consumers rather than for the benefit of the storekeeper or middleman. There was a real need for such a store that would enable their money to go a little farther in the purchase of the necessities of life. The difficulty was of course that they did not have any capital —the phrase is familiar. They began, however, to collect what money was available until they had enough to rent a store, to buy a few supplies, and begin their enterprise. Robert Owen was the leading spirit in this movement, and he has rightly earned the title "The Father of Co-operation."

From such a meagre beginning the enterprise has grown until now it includes every phase of industry, and has grown to such a point that millions of people now believe that were the principle of the co-operative system of industry universally applied it would not only solve our economic problems, but would bring into being an ideal world situation.

The work of running the store was divided among the members—one was cashier, another salesman, another treasurer, and so forth. Naturally, they were laughed at and ridiculed by the business people of their village. *But they stuck to their purpose!* That store served as a model for other people with similar desires. There was not much profit in the first week, but at the end

of 1927 the surplus dividend for the year amounted to £27,000,000. The twenty-eight members in the first year had increased to 6,000,000 by 1927, which, with their families, represents two-fifths of the population of Great Britain. The mustard seed had become a mountain!

As soon as the number of stores began to spread, wholesale discrimination arose on the part of those who wished to discourage the co-operative enterprise—the private vested interests. The discrimination on the part of wholesalers led to the formation of wholesale co-operative stores, with central warehouses.

The co-operators next felt that they must get nearer the producer so they decided to become their own brokers and sent their representatives to all parts of the world, establishing purchasing agents in every great market on the globe. They had thus become their own retailers, wholesalers, brokers, and purchasing agents. They next became their own producers. They built a long line of factories, first for food-stuffs and later for other commodities, until to-day there are in Great Britain one hundred and sixteen factories, producing practically all necessities of life.

They next began to grow their own raw materials. To-day the co-operative societies in Great Britain own more than sixty-six thousand acres of farm land, and rent ten thousand additional acres.

By 1913 the co-operative societies were selling over 27,000,000 pounds of tea. It was natural therefore that they should follow the tea trade to its source. As early as 1902 their first tea estate was purchased in Ceylon, and to-day nearly all the tea which the co-operative societies handle is produced on *their own farms.*

It was inevitable that they should have their own sea carriers, and stop paying tribute to privately-owned ships. To-day goods from all parts of the world are shipped in the co-operative company's *own steamers.*

Next, it seemed desirable to provide acceptable homes for their members without paying exorbitant rents to landlords so that as early as 1907 about fifty thousand *dwelling-houses* were constructed, most of them to ultimately pass to the ownership of the individual members.

Another step was to set up their own institutions of *credit and finance* so in 1872 the English wholesale society began its career as a banker. This was a wise move, and saved many thousands of pounds from going into the pockets of private bankers.

Almost immediately an *insurance* department sprang into existence which to-day carries almost any kind of insurance, together with collective insurance.

The foregoing is very briefly a rough sketch of the growth and development of the *co-operative movement* in Great Britain. A similar story might be told of other countries—Germany, France, Belgium, Denmark, and Russia. Co-operation has made little headway in certain countries, the most noteworthy being the United States of America. In America there has been very little consumer co-operation, and private profit has not been eliminated from producer associations for the sale of their produce. The foregoing outline having, however, indicated *the exceedingly practical character of the movement*, we shall now briefly consider the heart of the movement—*its basis of organization.*

The success and promise of further success of the co-operative moment lies in its very basis of organization.

Co-operation is a way of life, and simply a way of conducting business without profit, or rather with the surplus going to the consumers, instead of to the investors. It enlarges the ownership to include the patrons. Contrast with this private ownership the individual or company who sell products to other people for more than they cost and pocket the difference in the way of profit dividends.

Profit corporations are owned by stockholders, and any profits that accrue go to them. Stockholders have one vote for each share of stock, and control rests in the hands of those who own the majority of shares. Now, if the stock should all be owned by the people who produce and buy the products; if the profit were given back to the stockholders in proportion to the amount they spend for the products, and not in proportion to the money they had invested; if only a regular low rate of interest were paid for the capital put into the business; and if each member had one vote only, no matter how much stock he owned—*then the corporation would be a co-operative society.*

While the definite organization is determined by the societies themselves, these are the fundamental principles:—

(1) each member, regardless of the amount invested, has one vote;

(2) a legal and fixed rate of interest is paid on capital;

(3) surplus, after a fund for interest on capital stock, reserve, and education, is returned to the member in proportion to patronage;

(4) unrestricted membership, although each member is expected to invest some money;

(Continued on page 218)

WEEDS AND THER CONTROL

By S. C. Chowdhury

The farmer has a number of enemies. Weeds are one of them. They decrease the value of grain and seed crops, interfere with the growth and use of forage crops, and greatly increase the cost of agricultural operations. Many weeds are conspicuous, in our fields, gardens, and lawns, and their presence highly depreciates the value of such lands. Some weeds are poisonous either when eaten or when handled, and some impart an unpleasant flavour to dairy products. Moreover, weeds very often harbour—in their roots, stems, and leaves—insects, fungi, and bacteria, which are the causes of the numerous diseases of our crop plants. From all these considerations the growth of weeds on the farm is highly undesirable.

The Conflict of Life.—In nature there is a hard struggle for existence. The unlimited spread of organic life is held in check through unfavourable conditions of the environment and by the struggle which goes on continuously between different individuals of the same species of plants, between the individual of one plant species and those of the other species of plants, and between certain plant species and animal species. All plants in nature are contending for some place in which to live and multiply. The more successful the invasion, the more inimical they are to other plants. Living organisms become a pest when their growth remains unchecked. They overrun the fields, and we call them weeds. Man, after centuries of hard toil, has cleared the jungle land for his agriculture. But the jungle is all the time claiming its own; it is trying to ramify and invade the cultivated areas of the farmer. And the farmer must remember that he has to maintain an incessant fight by slowly gaining knowledge of how to keep down weeds. It requires the same persistence on his part now as in the past. If there is a slight slackening on his part, he will find his crop overpowered by weeds.

Attributes of Weeds.—Weeds have one or all of the following attribute:—

(1) They are adapted to a wide range of conditions;

(2) They are very hardy;

(3) They have most highly-developed reproductive organs;

(4) Many of them have a life-cycle similar to the cultivated plants with whom they are associated;

(5) They produce seeds or other reproductive bodies in great abundance;

(6) Most of them have a highly-specialized root system; and

(7) The seeds and fruits are provided with highly-specialized mechanisms for their easy and sure dispersal.

Weeds and Their Classification.—Weeds are plants that are undesirable, and hence not wanted by the farmer in his field, garden, or lawn. Any plant may be a weed at times. A potato plant or a maize plant is a weed when it volunteers in other crops and becomes a nuisance. "When any crop is too thick, there is competition among fellows, and the weaker and useless ones are weeds to the better ones."

There is no one basis for the classification of weeds. They can hence be classified from different points of view; but from the practical point of view it will be found convenient to divide weeds into two classes—terrestrial and aquatic.

Terrestrial weeds are those that are found on land. They can be further divided into two general kinds—

(1) Weeds that invade cropped lands, orchards, or gardens and compete for space, food, light, air, and water with the plants the farmer grows; and

(2) Weeds that inhabit waste or unoccupied areas, e.g., forests, jungles, etc.

Aquatic weeds are those that are found in water. They are less numerous in number than the terrestrial weeds, but they are more dangerous than the latter. They grow with extraordinary rapidity *(a single plant of water hyacinth, if allowed to grow unchecked, is capable of covering 300 square feet of ground in four months)*; and, owing to the great absorbing power of their roots, they seriously impede the flow of water, hinder navigation, and are a serious pest in the rice-fields. Moreover, they harbour snakes and leeches, which sting both men and animals and are the cause of the numerous loss of lives which occur every year in Assam, Bengal, and Burma.

The Problem of the Destruction of Weeds.—Weeds do great damage, and good agricultural practice therefore necessitates their speedy destruction. From the very beginning of agriculture man has tried means after means for the control of weeds, but, in most cases, his attempts have failed either wholly, or, if lucky, partly. There is nothing to be astonished at at this failure. The problem of the destruction of weeds is a difficult task, and it cannot be solved by following all haphazard methods hitherto tried by farmers. *The first and the most important step*, it must be remembered, in the destruction of weeds *is the acquirement of*

detailed and definite knowledge of the life-history of the weed. Of this very little is known. The farmer who strains all his nerves to clean his fields of Batheva (Chenopodium album) knows little about the habit of this plant. He fails therefore in all his attempts.

It must be remembered that the control of weeds depends, to a large measure, on the acquirement of a definite and detailed knowledge of the life-history of the weeds. If a farmer gains the knowledge of the life-history of a weed, he knows the "weakest" point in the life of that plant. He can easily check the weed at that point and kill it for good.

Before attempting any measure of control the following information should be gathered about the weed with great care and caution:—

(1) When does the weed germinate? i.e., when is it first seen appearing above the soil?

(2) When does it flower and bear seeds or fruits?

(3) With what special crop or crops is it particularly associated?

(4) What is its general effect on the crop? and

(5) Can it be utilized as cattle feed or for any other purpose?

If a farmer studies these few simple things about the weeds that are found on his farm for at least two consecutive years, he will know everything about the life-history of those weeds, and will be in a better position to devise means for their destruction than when he was ignorant about these and tried means at random.

Eradication of the Weeds.—There are four possible methods that can be tried by the farmers in eradicating weeds on their farms. They are as follows:—

(1) By the introduction of a parasite which is usually a fungus;

(2) By the spraying of herbicides, e.g., copper sulphate, salt, carbolic acid, kerosene, sulphuric acid, caustic soda, etc.;

(3) By the application of steam; and

(4) By mechanical collection and destruction.

Fungal Parasite.—Little need be said about the adoption of a fungal parasite for the destruction of weeds. In this case, the remedy may prove worse than the disease because it is not definitely known that the fungal parasite introduced for the destruction of the weeds would not subsequently attack the economic crop. In most cases, it may be found that the fungus leaves

the weed and attacks the crop at the very outset. This method is therefore fraught with more danger than good. It should not, on any account, be used for the destruction of weeds on the farm. For treating weeds on the roadside, they can be used under certain circumstances. On all accounts it is a good practice not to try them at all.

Herbicides.—Chemicals have been used extensively, and are also used to-day in some countries, for the killing of weeds. And it has been reported that, in various cases, chemicals intelligently used have been found more expeditious and economical in the destruction of weeds than any other means for weed killing.

A large number of poisons are known to-day to the modern chemist for destroying plant growth. But there are a number of practical difficulties which arise as to their use as herbicides.

The first difficulty arises from the fact that, when a herbicide is sprayed, it kills only the upper shoots of the plants and fails to kill the roots that lie buried in the soil. The shoots and the leaves dry up, but soon the plant rises up again from the living root in the soil.

Herbicides can be successfully used if they can be applied to the root, and not to the shoot. An exhaustive study of plant physiology has shown beyond doubt that a chemical or any other solution is carried by the ascent of sap upwards, and not downwards. Any herbicide applied to the shoots therefore fails to reach the roots in the soil, and hence fails to kill the plant.

The second difficulty arises from the fact that it is difficult, in most cases, to use the herbicide to kill the obnoxious plants without working permanent injury to the soil or to the neighbouring cultivated plants. If the former difficulty of applying herbicides to the roots can somehow be met, still this difficulty is a practical hindrance, and has limited the chief usefulness of chemicals as herbicides in the following cases:—

(1) When an especially obnoxious weed occurs in a limited locality and is to be destroyed regardless of the consequences to the soil of neighbouring plants.

(2) When the weed plants are much more sensitive and much easily acted upon by the herbicide than the associated useful plants.

(3) When the weeds occur on roadsides and paths where the making of the soil sterile permanently does not matter much.

The use of herbicides is neither an intelligent method of killing weeds nor an economical practice. It fails to destroy the weeds, and means a waste of public funds. The writer, spraying

a few herbicides, e.g., salt, copper sulphate, carbolic acid, and caustic soda, in the field has failed to kill weeds like Motha (Cyperus rotundus), Dub (Cynodon dactylon), Bathwa (Chenopodium album), Convolvulus arvensis, and Cnicus lanceolatus. The leaves of the plants, after the spraying, collapsed and became a huddled mass of tissue, but the roots—a power hidden from the sight of men that gives the plant its energy for struggle—remained alive, and the plants rose up again just as before. The writer is carrying on some investigations along these lines and will publish his results in one of the future numbers of this journal; but the results which he has achieved up to the present, have cleared up a lot of obscurity that has eclipsed the subject and he is now inclined to say that the use of herbicides for the killing of weeds is a blunder, and an enormous waste of money. The farmers will do good if they dissuade themselves from a repetition of the blunder.

Steam.—"Live" steam has been used extensively in the West for killing weeds, but in almost all cases it has failed to meet the desired end. The failure was due to the fact that the steam only came in touch with the leaves and stalks which were split and discoloured by the steam, but it failed to reach the buried roots in the soil. The result was that new shoots appeared in a very short time from the scalded plants. The use of steam for the destruction of weeds is limited for the following reasons:—

(1) It is a very costly affair;

(2) When steam is turned into unploughed ground, it kills only the shoots of the plants, while the roots remain alive;

(3) When the field is ploughed and cross-ploughed in order to expose the roots of the weeds to the action of steam, it is successful to a greater extent than when applied to the shoots. But, in this case too, it fails to reach all the roots, some of which lie concealed in the soil. And, if one escape death, it invades the whole field again;

(4) When "live" steam is passed in the soil, it kills all forms of life in the soil especially the nitrifying bacteria; hence there is the greatest danger of the soil becoming sterile;

(5) When steam is passed into the soil, it lowers the humus content of the soil, and destroys a number of plant-food substances; and

(6) Steam cannot be passed in a soil where a crop is standing.

From all these considerations it is quite evident that the use of steam for killing weeds is impractical, and entails a great expenditure with the least outcome. Steam therefore cannot be used for the destruction of weeds.

Mechanical Collection and Destruction.—Practical experience at the Allahabad Agricultural Institute Farm and at other places shows that a better step in comparison with the three cited above is the collection of the weed and its destruction. To some the cost of labour for this purpose may seem prohibitive but, a thorough study will reveal the fact that this method is more efficient and economical in the end than the others described above. But it should be remembered that, in order to get the most desirable results, they should be collected at a definite time. For this, as has been mentioned above, a thorough study of the life-history of the plant should be made, the different modes of its reproduction studied, and the plant attacked at the most vulnerable point in its life-cycle. The plants should be collected just before flowering and seeding, with all their roots. In this connection, it is worth while to remember also that, under all circumstances, weeding should be done on a sunny dry day, and when there is no possibility of rain for the following seven days at least. This gives the plants the least scope for regermination due to lack of moisture. The collected plants should be either burnt and the ash applied to the field or allowed to rot in a pit or manure pile and applied to the field when well rotted. This method of destroying weeds is more economical, practical, and satisfactory than the other three mentioned above.

Control of Weeds.—*The control of weeds is more important than its eradication.* The use of chemicals, "live" steam, fungal parasite, and the mechanical collection and destruction of the weeds offer no specific cure-all against them. Cultivation, rotations, and watchfulness against the introduction and scattering of weed seeds are all of more fundamental importance in combating weeds than chemicals, steam, fungal parasites, and their mechanical collection and destruction. No doubt, in some special, but very rare, cases, chemicals, fungal parasite, and steam have proved very successful; but one should not be blind to the fact that these methods adopted for the extermination of weeds are secondary rather than primary. A chemical can kill a plant, but it cannot stop the growth of a new one which follows the former without destroying the productive capacity of the soil.

The measures taken *to control weeds* depend first, of all, upon whether the weed is an annual, a biennial, or a perennial. It is obviously one problem to deal with perennnials and another problem to deal with annuals and biennials. In the annuals and

biennials which are generally propagated by seeds it is necessary only to prevent seeding so far as dissemination or persistence is concerned. A single plant of many common weeds will produce hundreds or thousands of seeds. Moreover, not all of these seeds may germinate the first year, and seedlings may continue to appear for several years. Harrowing and cultivating farm lands not only will improve soil conditions for the growing crop, but they also destroy a countless number of weed seedlings, which in good soil is far more important. Pasturing off the weeds with sheep, goats, and cattle are efficient means of destroying weeds if practised before they come to bloom. On the other hand, in the case of the perennials, it is necessary to destroy or crowd out the entire plant, root and all.

The control of weeds is a major part of farm management, and upon its proper management depends, to a considerable extent, the outcome of the business. The subject of weed control has attracted the attention of all tillers of the soil at all times and in all regimes. But, in most cases, they have failed to achieve the desired result due to their apathy in following the cardinal points of weed control. In brief, *the following are the cardinal points in weed control:*—

(1) Practice of good rotation. This is essential because there are certain weeds which are associated with certain plants;

(2) Clean tillage;

(3) Cleaning up of roadsides where the weeds breed;

(4) Use of clean seed;

(5) Care to see that the manure does not carry weed seeds;

(6) Alertness to recognize new weeds when they begin to invade the neighbourhood;

(7) No weeds should be allowed to produce flowers and seeds; and

(8) Prevention of the growth of shoots. Depriving a plant of its photosynthetic tissues leads to starvation of the underground parts.

Insects and plant diseases are the plagues of the husbandman. But no less are the weeds a plague to the husbandman. They rob the soil of water and food materials and do a number of

other damages. The farmer should remember that all weedy fields are poorly-managed fields. Nature covers all areas, waste and cultivated; and nature knows why. But the farmer, in dealing with the weeds, should work out such a system of crop management as will afford the weeds the least opportunity to gain a foothold. Efficient agriculture is an efficient management of weeds. And the dexterity and the skill of the husbandman is judged more by the cleanliness of the field than by any other one factor in farm management.

(Continued from paye 207)

The voice of this great scientist and humanitarian has not rung out in vain. The war resistance movement has made extraordinary progress. *But it must have the support of every one of us who would make effective protest against the criminally insane bent of the mind of man which has bred that species of organized murder known as war.*

Members of the Oxford Union have gone on record as declaring that they will in no circumstances fight for King and Country, and their example has been quickly followed by members of other universities in Great Britain. In the United States the revolt has spread widely among college students, clergy, and others. Thousands of the clergy have signed a declaration that in no case will they bear arms for their country, and that, on the contrary, they will oppose any and all war with all of their power.

The declaration of the War Resisters' International, which we have signed, is as follows:—

"War is a crime against humanity. We therefore are determined not to support any kind of war and to strive for the removal of all causes of war."

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(5) cash sales at the market value;

(6) constant education in the principles and aims of co-operation; and

(7) federation with other co-operative societies with the ultimate purpose of national and world co-operation.

W. J. H.

OIL-CRUSHING IN MEERUT

By A. P. Mathur, M.A.

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Oil-crushing is an important industry of every village and town. This industry is mostly carried on by a section of people known as "Telis." In most cases, the teli presses seeds not to supply any outside order, but to sell the produce himself in the dearest market. For extracting oil every teli has a kohlu—an indigenous oil mill—which is driven by a pair of bullocks blindfolded. The kohlu is a very antiquated instrument, but still it continues to be used largely. It would be interesting to describe the mechanism of a kohlu, which is more or less simple and uncomplicated. In the words of Professor Mukerji, "It consists of a hollow wooden block buried very deeply in the ground. The cavity in the mill is shaped like an inverted cone, the apex reaching to about midway down the block. There it is 2 inches wide, and then it widens again; the triangular thus formed is the exit for the oil. The pestle moves in the hollow of the mill, at the end of which there is a ball which fits tightly into the narrow point of the cavity at the waist. It is in this portion that the oil-seeds are placed. A curved block of wood connects the pestle with the vertical post fastened to the horizontal board. The oilman sits on the board......The bullocks are yoked to the horizontal board. They are blindfolded lest they move in the circle. There is a peg standing up in the cavity amidst the seeds alongside the pestle. To its top is attached a horizontal handle, the other end of which is fastened to the upright post by another peg. The whole therefore revolves with the pestle, the first peg moving amongst the seeds concentrically. At the same time, the stirring is rendered more effective by the peg being perpendicular and the pestle on the slant."

In Meerut proper there are about 100 country kohlus, giving employment to 150 persons or thereabouts. Generally, the proprietor of the kohlu is himself the worker, and he is at times assisted by his women and children. The oil-pressers are mostly illiterate; they persist in their old methods, however unprofitable they may be. Recently, some electric kohlus which have come into use have proved far more economical than the primitive one. In Meerut there is one person who owns 8 kohlus, all worked by electricity. He is said to be reaping good profits. It would give some clear idea if we compare the results of the two types of kohlus.

Country Kohlus.—From the description given above it would appear that the country kohlu is something crude and inexpensive.

It can be set up for Rs. 50 on a rough approximation. A pair of bullocks is required to set the kohlu going, which can be had for about Rs. 100; thus the total investment of an ordinary teli comes to Rs. 150. Some telis carry on work with one bullock only and manage to reduce their initial outlay substsntially.

The oil is extracted in four "ghanis," each ghani consisting of 10 seers. Out of 1 ghani the yield of oil is about $2\frac{1}{2}$ seers, or 25 per cent; the total yield from 4 ghanis comes to 10 seers of oil. The telis ordinarily purchase the seeds from the market and sell the oil. Sometimes, however, they undertake to manufacture the oil out of seeds supplied by another, and get the wages. The charges ordinarily are from 3 to 6 annas, varying with the type of seeds pressed, which weigh 10 seers in each case; these are reduced to halves when the oil-cakes are given to the oil-presser.

Earnings and Expenses under the Country System of Manufacture.—

Expenses.—Sarsaun, or mustard seeds, are generally pressed by Meerut telis. The current market rate of mustard seed is, say, Rs. 3 per maund.

The cost of feeding a pair of bullocks normally comes to As. 10 per day.

Repairs and depreciation may be estimated at As. 2 per day.

Thus the total expenses per day amount to Rs. 3-12.

Income.—The outturn from a maund of seeds is 10 seers of oil, which, when sold at the market rate of Rs. 10 per maund, will fetch Rs. 2-8-0.

The by-product of the oil, *i.e.*, khal, or oil-cake, will be 30 seers out of 1 maund of seeds which would be sold for Re. 1-12 and Rs. 2-4 per maund.

The total income per day will come to Rs. 4-4.

Thus the net profit which would accrue to a teli would be As. 8 per day.

The profits of an individual teli are too meagre. Considering that oil-pressing is the mainstay of a teli's family, the earnings so derived are hardly sufficient for a bare subsistence. It may, however, be said that, if a teli really desires, he can easily mend his fortune. There is a good deal of demand for oil in Meerut as is clear from the fact that a good amount is imported from the Punjab, chiefly from the Lyallpur and Lahore districts. If the telis resort to modern methods of oil-crushing, they can turn out far larger quantities and can earn huge profits. The setting up of a modern plant, as will be seen from the figures given below, is neither complex nor very expensive.

Electric Kohlus

The latest method of oil-crushing is by electric kohlus. The yield of oil in this case is far greater than in the case of a primitive kohlu. It is 33 per cent in this case as against 25 per cent in the latter. Moreover, the latter method is subject to greater risks, the former being comparatively safe. In the country kohlus, where bullocks form the chief motive force, the oil-presser may have to incur huge losses if any of his bullocks die suddenly.

Let us see the expenses which the installation of electric kohlus means. For setting up 8 kohlus the owner had to spend as follows:—

	Rs.
8 Kohlus cost about	1,600
1 Electric motor, 10-h.p.	300
Fittings, etc.	200
Total Rs. ...	2,100

One electrically-driven kohlu will crush 10 seers of seeds in $1\frac{1}{2}$ hours; 8 kohlus working for 8 hours will therefore crush 10 maunds and 26 seers of seeds. Taking the yield at 33 per cent, it comes to 3 maunds and 22 seers of oil. The balance will be 7 maunds and 6 seers of cakes.

Other Expenses

	Rs.	a.	p.
10 maunds and 26 seers of oil-seeds, at Rs. 3 per maund	31	15	3
Electricity, 40 units	3	12	0
Labour, 4 men, at 6 annas each per day ...	1	8	0
Lubrication, rent, depreciation, and interest ...	4	0	0
Total Rs. ...	41	3	3

Earnings

3 maunds and 22 seers of oil, at Rs. 10 per maund	35	8	0
7 maunds and 6 seers of cake, at Rs. 2 per maund...	14	4	9
Total Earnings ...	49	12	9
Deduct Total Expenses ...	41	3	5
Total Net Profit Per Day Rs. ...	8	9	4

From the calculations it is clear that profits to the owner of the power-mill are not negligible. They can, however, be increased further if the mill is worked for some hours more. It can be safely worked for 10 hours a day without increasing much the overhead expenses.

Though the net profits are quite handsome in this case, yet we don't think this scheme has found favour with business-men to any appreciable extent. The reasons for this may be found in the following facts:—

1. The scheme involves a sufficiently large capital expenditure which is not within the means of ordinary telis to procure.

2. The telis are too narrow-minded to think of any improved device. They would prefer, like their blindfolded bullocks, not to stray from their chalked-out rut. They require education with a professional bias.

3. There is some prejudice against oil extracted from mills. "It is believed that the iron press discolours the oil, and that a disregard of cleanliness will affect the quality of manufactured oil, the oil from the indigenous wooden ghani being far purer and more sparkling. This may be pure conservatism." The by-product, i.e., khal, produced by the mill is also regarded as not very satisfactory. It is drained absolutely dry of oil, and is not very nourishing. It therefore fetches less price.

These handicaps are not, however, insurmountable. For a teli of ordinary means it is not necessary that he work 8 kohlus. He can show comparatively good profits, and can maintain himself decently if he works only two kohlus, the capital investment for which would not be much. If, even then, he finds difficulty, he may co-operate with another teli and work 2 power kohlus in partnership. The last scheme is quite practicable, and not much less remunerative. Under the last-mentioned scheme the expenses and earnings would be as follows:—

Expenses

	Rs.
2-power Kohlus will cost about	400
1 Motor electric, 3-b.p.	190
Fittings, etc.	60
Total Rs. ...	650

The capital expenditure, when divided among two men equally, comes to Rs. 325 per head. This sum is not very difficult to procure when they can afford to spend about Rs. 200 on a country kohlu.

OTHER EXPENSES

(The men themselves will work, and will engage no labourer.)

	Rs.	a.	p.
The mill will work for 10 hours and will crush about 3 maunds and 13 seers a day, the cost of the seeds, at Rs. 3 per maund, being ...	10	0	0
The consumption of electricity would be 12 units, totalling	1	2	0
Other expenses, including depreciation, etc. ...	0	6	0
Total Expenses Rs. ...	11	8	0

EARNINGS

	Rs.	a.	p.
1 maund and 4½ seers of oil, at Rs. 10 per maund	11	2	0
2 maunds and 8½ seers of cake, at Rs. 2 per maund	4	6	0
Total Earnings Rs. ...	15	8	0
Total Net Profit Per Day ...		0	0

The profit, when divided equally among two persons, comes to Rs. 2 per head. This is quite large as compared with the profits in the country kohlu, where it is only 8 annas. The profits under this scheme clearly establish its advisability. The primitive method must go in the face of the present disadvantages of the trade. If the scheme, as outlined, is followed, it will not only better the condition of a vast number of telis, but it will benefit immensely the agricultural community as a whole. This improved and effective system of manufactnre would lessen the export of oil-seeds, and consequently the oil-cakes, its by-product, would be retained for the soil. Dr. Voelcker has said truly, "to export the entire oil-seeds is to export the soil's fertility."

"This mash is recommended for your poultry breeding stock:"

Maize	1 part
Bone or fish	1 "
Oats	2 parts
Atta	2 "
Bran	6 "

PROBLEMS IN ORCHARD PRACTICE

By W. B. Hayes

Caring for an orchard in India is not at all the complicated matter that it is in such countries as America, where numerous diseases and insect pests must be constantly fought. There, spraying, dusting, and fumigation are often part of the annual routine. Here, all that is commonly required is ordinary cultivation, and the supply of water and plant food. Nevertheless, many orchards receive very inadequate care.

The aim of cultivation should be to reduce to a minimum the growth of grass and weeds, except during the monsoon season. In the climate of Great Britain it is possible to grow fruit with the soil covered with a permanent sod, but this is out of the question in most parts of India. Experiments at Pusa some years ago proved that the sod interfered with the growth of all kinds of fruit tested, and, in most cases, brought about the death of the trees within a few years. During the rainy season weeds may be allowed to grow, or a green manure crop may be planted. Near the end of the rains the orchard should be ploughed or dug. The ploughing need not be very deep, and, in the case of shallow-rooted trees, such as citrus, should not be more than or 6 inches. During the rest of the year all that is needed is an occasional harrowing in order to prevent the growth of weeds and keep the surface soil so soft that irrigation may not be difficult.

In a climate such as that of northern India, where there may be practically no rain for nine months, *irrigation* is of prime importance. Once established, deep-rooted trees like the mango will live without irrigation, but even these need water in order to mature an optimum crop. The need for irrigation is generally recognized, but the common method is very unsatisfactory. In most cases, a small basin is constructed around the trunk of the tree. It is not realized that the tree absorbs moisture mainly through the growing region at the tips of the roots. These extend into the soil at least as far as the branches spread in the air, and root ends are very scarce near the trunk of a mature tree. The practice of most Indian gardeners is as if they were to bring a vessel of cool water to a thirsty man and pour it on his belly. The aim in irrigation must be to moisten the region in which the feeding roots are found. It is often undesirable to wet the soil near the trunk. Basins may be made so as to include all the soil, except that nearest the trees, and filled with water. Perhaps a better method, in most cases, is the use of furrows. These should be near the outer edge of the branches. In the case of small trees, a circular furrow around each tree is desirable,

but with mature trees furrows down the centres between the rows may be all that is necessary. Details of methods would be out of place in this article.

The frequency and amount of irrigation depend on the soil, the trees, and the season. At each irrigation the aim is to wet the soil as far down as the roots penetrate. Water which goes below this level is largely lost, and carries nutrients with it. Between irrigations the soil should dry out almost to the point at which the trees begin to wilt. A light, sandy soil naturally requires more frequent, and less heavy, irrigation than a heavy soil.

Manuring is an important subject on which very little can be said with authority. In this field experimentation is badly needed. Concerns selling fertilizers advocate their use in large quantities, but offer little proof. There can be no doubt, however, that in most Indian soils there is need for nitrogen, and that this is most valuable when supplied in organic matter. Dung, oil-cake, and green manure are desirable forms. In some cases, commercial fertilizers, such as nitrate of soda, may be economical. In many parts of the world it is a good practice to apply potassium and phosphates also, but Indian orchardists should be slow to do so until there is experimental evidence of the value of this practice. Citrus-growers in California, following the advice of the fertilizer companies, instead of the experiment stations, spend thousands of dollars every year for these elements, but all the evidence indicates that this is of no value. Both individuals and experiment stations may well carry on experiments as to the situation in India.

Pruning is another problem on which very little is known, and on which a little knowledge may be a dangerous thing. Pruning should be regarded as an evil, but as one sometimes necessary. All pruning involves the sacrifice of leaves, and both growth and fruitfulness depend on the materials manufactured in the leaves. Pruning should therefore be kept at a minimum. On the other hand, an unpruned tree is likely to be weak and subject to breakage, as well as ugly. It is possible, by judicious pruning, to secure a strong, shapely tree, and often to increase both the quality and quantity of the fruit. The amount and type of pruning vary with different kinds of fruit, and much experimental work remains to be done on Indian fruits. Until more is known, the safest practice is to prune the young tree to one trunk with from three to six main branches, and to restrict further pruning to the removal of dead and broken branches, and a little thinning out in case the head becomes very dense.

There are more poultry under domestication than any other animal or bird.

THE WASHING AND STERILIZATION OF DAIRY UTENSILS

By W. J. Hansen

Why Dairy Products Spoil.—We have noticed over a period of years that the monsoon season, of high temperatures and high humidity, is the most critical period of the year as far as the keeping quality of milk and dairy products is concerned. At this season it is a common sight to see mildewed books, boots, clothing, and foods that have become unfit for human consumption on account of decomposition by micro-organisms.

The modern electric refrigerator, both in the home and in the dairy, has done much to eliminate wastage and increase the keeping quality of perishable goods—amongst which we must list milk as of the most importance.

In the dairy a common method in use for many years was the fastidious use of steam for sterilizing utensils. Modern research has, however, placed in our hands chemical methods which may complement, supplement, and be substituted for the use of steam. Certain chemical methods of sterilization can be utilized in the home, as well as in the dairy, and will be briefly discussed in this article.

Spoilage of milk is due to the action of bacteria or germ life. The bacteria act on the milk sugar of milk—the lactose—break it down to lactic acid, and destroy the equilibrium of the milk emulsion. Bacterial action, under optimum conditions, continues until approximately 1·0 per cent of lactic acid has been produced, at which point further bacterial action is inhibited. At ordinary room temperatures during the monsoon season bacteria increase in arithmetical progression every 20 to 30 minutes, one bacteria in the course of 18 hours increasing many million times. Milk produced under the most sanitary conditions may contain as low a bacterial count as 5,000 bacteria per cubic centimetre, whereas milk produced under filthy conditions probably will contain a count of several million per c.c. In the preservation of milk it becomes therefore of the utmost importance to keep down the initial bacterial count in the milk. To this end attention must be given to sanitation and the proper washing and sterilizing of utensils.

Milk of satisfactory keeping quality must contain few bacteria. This can be accomplished by, firstly, preventing the entry of bacteria into the milk; and, secondly, by checking the growth of the few that do enter. This last requirement is met by the proper cooling of the milk, and will be fully discussed in a succeeding article.

In order to take steps to reduce the bacterial contamination of milk, we must know the sources of the contamination and their

relative importance. Your attention is drawn to the following table in which the various factors are set forth:—

Increase in Bacterial Count under Different Production Methods

(Result of experimental work by Dr. Lockhead, Dominion Bacteriologist, Ottawa; the results are presented for comparison)

		Bacteria per c c. in the milk
1.	General sanitary conditions throughout ...	3200
2.	Feeding hay before milking	6540
3.	Sweeping up before milking	4490
4.	Removing manure once, instead of twice, daily	22210
5.	Using water, instead of disinfectants, to wipe udder	6390
6.	Udder not brushed before milking ...	5530
7.	Neglecting to brush cattle daily ...	19230
8.	Fore-milk not discarded	3770
9.	Milkers' hands not washed before milking ...	5220
10.	Wet-milking	3350
11.	Open pails, instead of covered	4560
12.	Cleaning pails with hot water, instead of steam or chemical sterilizer	14460
13.	Cleaning pails with cold water	33650

It will be seen that washing pails with cold water is *not* an effective way to reduce the bacterial count as the vessel *may* become clean to the eye, but still remain bacteriologically unclean, and a source of contamination.

Thorough Washing of Utensils

There is no substitute for thorough washing of all utensils!— This should be done before a dried film of milk has a chance to form on the surface. The milk residue of cans, buckets, pails, bottles, etc., should be removed by rinsing with cold, preferably lukewarm, water. Hot water should never be used to rinse the milk residue from utensils because it scalds the film of milk on to the surface of the container, making it more than doubly difficult to remove. The utensils should then receive a thorough scrubbing with a brush, using hot water containing soda or any reliable dairy cleanser. A small wash vat is convenient if a number of utensils must be cared for.

Utensils, cleaned as detailed above, are now ready for the next step—"Sterilization." In this step the remaining bacteria are removed or destroyed as completely as possible. Sterilization means the complete deduction of all germ life, but, in practice, it amounts to the reduction of germ life to an insignificant amount.

It should be clearly borne in mind that sterilization cannot replace the thorough washing of utensils; both steps are necessary for effectiveness.

Sterilization Methods

A. *Steam, with and without pressure.*—Where a proper sterilizing chamber or autoclave is available, treating utensils with steam at fifteen pounds' pressure within the chamber will destroy all bacteria present, even the highly-resistant spore forms. When no sterilizing chamber is available, each utensil may be steamed over a jet for at least three minutes.

Steam boilers are rarely encountered on any but the large dairy farms. Small dairy farms may improvise some form of home-made non-pressure steam sterilizer.

B. *Scalding.*—Scalding utensils with boiling water is the commonest method of sterilizing dairy utensils on dairy farms. Successful results depend upon (1) the temperature of the water; and (2) the quantity of water used. For an 8-gallon can a quart or more of boiling water is required to sterilize it effectively. In addition to pouring the boiling water around the insides, it is well to replace the lid and roll the can in such a way as to make sure that every inch of the inner surface is treated. Before emptying out the water, the lid may be treated by inverting the can for a few seconds. A somewhat superior method for a large number of utensils, such as pails, strainers, separator parts, disks, etc., is to immerse the utensils for a minute or two in a tank filled with boiling water.

C. *Chlorine Compounds.*—Few farms are adequately equipped for properly sterilizing utensils by either the steam or hot-water method. Modern chemistry has devised a way whereby the germ-killing properties of the chlorine group of chemicals have been utilized. In this method the chemical is dissolved in cold water, thereby saving fuel and time, and the utensils are then treated with this solution.

Because of the convenience of this method, it is being widely used both in the milk plant, the factory, and the farm, and, where applied intelligently, it gives results which, in many cases, surpass those obtained by the hot-water rinse method.

The germ-killing power of chlorine compounds is proportional to the free or available chlorine which they contain. This free chlorine is being constanly liberated and lost, resulting in a more

or less rapid decrease in strength, particularly in dilute solutions prepared for use. Either commercial or home made products may be used. With the use of this method of chemical treatment, *thorough cleaning of the utensils is a very fundamental necessity.* The efficiency of this method depends upon—

(1) the use of a solution of sufficient strength;
(2) a sufficiently long period of contact between the solution and the inner surface of the utensils; and
(3) the absence of milk residue, dirt, or other organic matter which destroys the sterilizing power of the solution.

Tropical Chloride of Lime.—Chloride of lime is probably the oldest chemical disinfectant. It proved of invaluable aid during the world war, during which period it was shown that chlorine solutions so dilute as 1:500,000 possess equal disinfecting powers with 1:250 carbolic acid against streptococci in water. Ordinary chloride of lime is unstable in hot and moist climates. It, however, is claimed that tropical chloride of lime will keep for months in hot climates without appreciable loss in available chlorine. For sterilizing milk bottles, cans, pails, strainers, or separator parts wash the utensils with a solution containing 2 to 3 oz. of tropical chloride of lime per gallon of water, leaving it in contact not more than a few minutes.

Drying Utensils.—After any process of sterilization (except steam under pressure for twenty minutes) a few highly-resistant organisms survive. If any trace of moisture is left on the utensil, these survivors will increase at a surprising rate at ordinary temperatures. In fact, cans which are thoroughly washed (not scalded) and placed on an outdoor draining-rack contaminate the milk less than cans which have been washed, thoroughly scalded, drained, and then stood indoors with the lids on. *Ater sterilizing, the utensils must be dried.*

Up-to-date dairies employ a can-dryer, using a blast of hot air. A good open-air draining-rack exposing the utensils to the action of both sun and air can be used by smaller dairies. The utensils are inverted and placed on such a rack just following the sterilization treatment.

On no account should a cloth be used for drying the utensils. Such a practice is bound to add thousands of bacteria to the can surface. People object to an outdoor rack on the score that dust may get into the cans. But dust is more desirable than leaving the cans with a film of moisture in them in which millions of bacteria will develop. If there is serious trouble from dust, the utensils should be rinsed again with boiling water just before using them in the succeeding operations. Draining the utensils well will avoid any chlorine taint or smell appearing in the milk.

THE PLANT

By C. P. Dutt

The plant kingdom is composed of a great number and variety of plants. Over 250,000 different kinds of plants exist on the earth. Plants are the smallest, and also the largest, of living organisms. Some plants are so small that they can be seen only with the microscope. Our gigantic trees are the largest of plants. Ranging between the smallest and largest plants there are many intermediate forms. Plants which produce seeds are known as Seed Plants. These are the most highly developed, most attractive, and furnish most of our food, fibre, timber, and many other products for the welfare of man. In relation to agriculture, these concern us most as they include most of the crop plants and nearly all of the weeds. However, one should not conclude that the simpler plants are of no importance. Some of these are of great economic importance in various ways. A group of the simpler plants known as fungi causes most of the plant diseases resulting in great destruction among cultivated plants. Another group known as bacteria decomposes organic matter, increases the nitrogen of the soil, and affects soil fertility in many other ways. Bacteria also cause many plant diseases, and most animal diseases. These have to be fought at considerable cost.

These plants differ much in form and habit of growth. Regardless of differences, the individual plant must carry on the various processes necessary to maintain life, and must .produce offspring to maintain the existence of the race to which the individual belongs. The activities of the individual plant are twofold: namely, vegetative and reproductive. Vegetative activities are those that have to do with the growth and maintenance of the individual plant. These activities include absorption of materials from the soil and atmosphere, manufacture of food, transfer of materials in the plant, respiration or break-down of foods by taking in oxygen and giving off carbon dioxide, transpiration or water outgo through the leaf surface, and assimilation or the changing of non-living matter into living matter. In seed-bearing plants the stems, leaves, and roots are chiefly concerned with carrying on vegetative activities; the reproductive activities are those that have to do with the multiplication of the individual and the preservation of the race of the plants to which the individual belongs. These activities include both sexual and vegetative reproduction. The flowers are chiefly concerned with sexual reproduction. Some plants may be propagated by using vegetative parts. Such reproduction is called vegetative reproduction. In crop plants stems are chiefly concerned in vegetative reproduction; some examples are potatoes, sugar-cane, and sweet potatoes.

The Body of a Seed Plant

The body of a seed plant is composed of two main parts: the shoot system, consisting of the aerial parts; and the root system, consisting of the underground portions. The shoot system consists of stems, leaves, flowers, fruits, and seeds. The stem bears and supports the other portions of the shoot. It is the axis of the shoot, and is comparable to the root. The root system consists chiefly of roots. Stems and roots are both cylindrical structures. There are certain distinguishing differences between them. These are as follows: (1) stems are divided into nodes and internodes, while roots are not; (2) branch stems arise at the nodes and in the axils of leaves, while roots branch anywhere; (3) the internal structure of the stem differs from the root; (4) the branch stems originate at the surface of the main stem from actively growing tissue at the tip, while branch roots arise from tissue (pericyle), which is situated far the below the surface of a larger root; and (5) the growing point of the stem is covered and protected by rudimentary foliage leaves, while the growing point of the root is protected by a special structure—the root-cap.

As previously mentioned, the shoot is composed of stems, leaves, and flowers. These parts or organs have definite functions to perform. The main functions of the stem are: (1) to support foliage and floral leaves; (2) the conduction of water and salts from the soil; (3) food storage; and (4) some stems act as organs of vegetative reproduction. Stems are further divided into nodes and internodes. The swollen zones of the stem from which the buds and leaves arise are the nodes. The leafless regions between these zones are internodes. The growing point at the tip of the stem with its protective covering is the terminal or apical bud; a bud on the side of a stem is a lateral bud; and one, in the axil of a leaf, is an axillary bud.

The functions of leaves are food manufacture (both carbohydrate and nitrogenous) and transpiration (water outgo).

Reproduction is the only function of the flower.

There are several types of shoot systems, three types are recognized. These are herbs, shrubs, and trees. Unusually distinction is made between these three types. Trees and shrubs are woody. Herbs have less woody tissue. These are soft and tender. The tree has a main trunk with lateral branches. The branches arise from the main trunk at varying distances, and are smaller than the main trunk. The shrub has a small main stem. The branches arise at its base, and are equal to it in size.

Mention was made above that the root system consists chiefly of roots. Root systems differ in form. There are two common types of systems: these are the fibrous and tap-root

systems. The fibrous root system is one in which there are no dominant main roots; all the roots are small with numerous fine branches. As an example, the wheat plant possesses a typical fibrous root system. The tap-root system is one in which there is a large main root from which small lateral branches arise. As an example, the radish plant possesses a typical tap-root system. The root system of a plant has certain definite functions to perform. These functions are: (1) anchorage; (2) absorption of water and certain salts from the soil; and (3) food storage.

Balance Between Shoot and Root

The shoot and the root differ in the work they have to do. The shoot chiefly manufactures food and develops reproductive structures. The root is concerned with absorption and anchorage. The shoot and root are interdependent. The shoot is dependent on the root for its materials absorbed from the soil. The root is dependent on the shoot for the food which is necessary for its life and growth.

There is a balance between the shoot and the root. This has been well recognized in agricultural practice, in transplanting, and in pruning of plants. For example, when a young plant is removed from the seed-bed or nursery, many of the roots of the young plant are necessarily destroyed. The result is a reduction of the absorbing root surface. The approved practice is to reduce the shoot proportionately by cutting back or thinning it. The aim is to re-establish the balance between the two systems. Otherwise, the reduced root system will be unable to supply the larger shoot system with water and salts unless it is wisely pruned. If, on the contrary, the shoot is severely pruned, it will not permit normal growth and development on account of insufficient food-manufacturing tissue. An unbalanced condition between shoot and root is detrimental to the growth and development of a plant.

The Life Cycle

The life cycle of a plant is the series of changes through which it passes in the course of its development. This series of events in the life of a plant consists of germination, development of seedling, development of root, stem, and leaf structures of the more mature plant, development of flower, pollination, fertilization, and development of other seeds. In tracing these events one can begin at any point. Environmental factors may change the length of time of the life cycle of a plant. Optimum temperature, abundant water, and nitrogen in the soil many increase the duration of the vegetative period. The reverse of these may reduce it, and, on

the other hand, hasten flowering and seed production. Sometimes the life cycle is used as a basis for the classification of plants. This is a general classification. It is (1) annuals—plants that complete their life cycle in one year and then die; (2) biennials—plants that complete their life cycle in two years and then die; and (3) perennials—plants that complete their life cycle in more than two years.

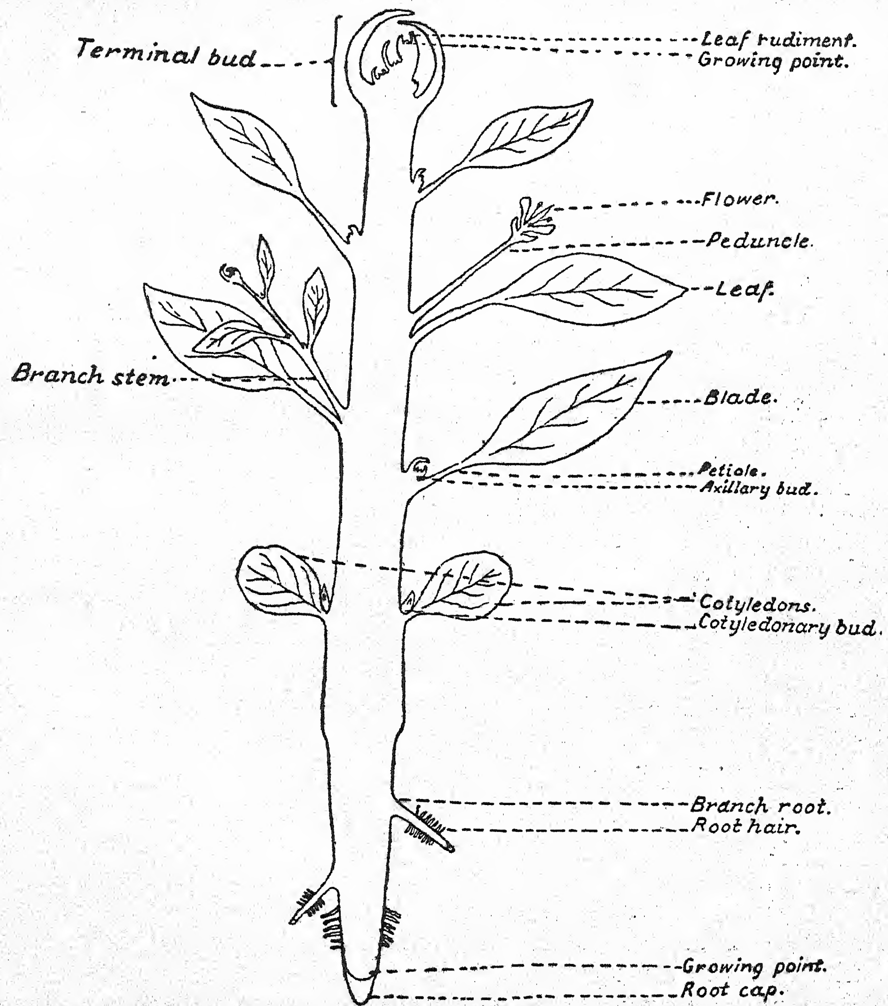


Fig. 1.— Diagrammatic representation of the main parts of a flowering plant.

ALLAHABAD AGRICULTURAL ASSOCIATION NOTES

Training Village Teachers.—Patwaris, having lost the influence which they commanded in the past amongst the rural population, agricultural enthusiasts now consider *village school teachers* to be the most efficient medium through which the knowledge of improved methods of agriculture can be introduced among the agriculturists in India.

Accordingly, classes were held for two weeks in the month of June as experimental measures in two important villages, Karali and Lakarigaon, in the Allahabad District, under the auspices of the Allahabad District Agricultural Association, for the training of district board school teachers in the agricultural industry. Several Government departments, besides the education department of the district board, also co-operated in making the experiment a success, and the programme of the training was outlined by Rai Sahib Jyoti Prasad, divisional superintendent of agriculture. Among those who delivered lectures were Messrs. Afzal Husain Chishty, Nand Kishore, and Mathur, agricultural inspectors, Dr. Nigam, district medical officer of health, Mr. S.K. Dixit, assistant registrar of co-operative societies, and a veterinary assistant.

The period selected for the training was not opportune as practical training in fields was not possible for there were no crops. This period was, however, selected due to the district board school summer vacation. *It is reported that over* 200 *teachers took advantage of the training.*

The Lakarigaon class-room was converted into a meeting-room on the eve of the termination of the training, and sermons were delivered by, among others, Rai Sahib Jyoti Prasad, divisional superintendent, Mr. Sitla Din, chairman of the district board education committee, and Pandit Moolchand Malaviya, exhorting the teachers to spread among the villagers the knowledge which they had gained.

Agriculture a Solution to Unemployment.

Pandit Sitla Din felt that the solution of the unemployment problem was to be found only in the development of agriculture—India's principal industry. He exhorted the teachers to form *societies in villages for the improvement of agriculture*, and should themselves combine to purchase *improved ploughs* in order to popularize them among the cultivators. He added that, if the villagers were prepared to maintain them, the district board could supply, free of cost, *bulls for breeding purposes.*

Prize To Be Given.

The chairman of the education committee further announced to the teachers that anyone writing the best article on agriculture would be given, as a reward, books on agriculture to the value of Rs. 10.

Several teachers who spoke at the meeting assured the officers present that they would do their best to carry into the villages the knowledge they had gained of the improved methods of agriculture.

Wah-Wah Plough.

Mr. Mason Vaugh, the engineer of the Allahabad Agricultural Institute, explained the advantages of the "Wah-Wah" plough which he had invented recently.

Pandit Moolchand Malaviya, the honorary secretary of the Allahabad District Agricultural Association, was the originator of the idea that village school teachers should be utilized for the spread of improved methods of agriculture, and the speakers paid a brilliant tribute to him for what he had been doing in connection with the development of agriculture in the district.

Extract from report of Allahabad Agricultural Association.

The following extracts from the report of the Allahabad Agricultural Association, submitted this month by Pandit Moolchand Malaviya, may be read with interest: —

"Knowing very well that for a long time the problem of unemployment has been causing great anxiety to, and engaging the serious thought of, persons interested in the general welfare of the country, there have been debates in the Assembly and Councils, and agitation in the Press and on platforms, but until now no practical work has been done to meet the situation. The longer the delay in solving the problem, the greater is *the risk of a serious economic upheaval in the country.* It is therefore expedient to start some sort of relief work for the millions who are now out of jobs. The solution, as everyone knows, is simple—*the development of industries in the country.* But the question before us is whether centralized industries in the form of mills and big factories can satisfy the needs of to-day.

Centralized v. Cottage Industries.

"There are countries where large-scale industries are at their zenith, and yet they are badly suffering from unemployment. As far as India is concerned, everybody is well aware that agriculture is the chief industry of this country. This development therefore of agriculture in India is alone likely to solve the problem and utilize the energy and intelligence of our young men which, at present, are being simply wasted for want of proper occupation. *By organizing and developing agriculture we can provide work for thousands of young men* who will be profitably employed, and this will lift the country from its present degrading poverty and destitution.

"Importance is attached to the economic aspect of life because it is thought that *the higher faculties of a person cannot*

be developed unless his primary wants with regard to food and clothing are adequately satisfied. This problem has had the serious consideration of our association from the date of its foundation. With the object therefore of providing unemployed young men with such work as may enable them to lead a happy and industrious life, the association proposed to develop agriculture.

"It is well known that for carrying out the above aims and objects the association requires an army of men, and a very large sum of money, which is not easy to get, especially in these days of general economic depression and financial stringency. As an alternative, the association moved the chairman of the education committee of the district board, Allahabad, with a view to having all district board school teachers, who are about 2,000 in number, trained in elementary agriculture, etc., for utilizing them in village uplift work. On getting his consent to starting training classes in the various tehsils the association approached the following departments of Government in order to get their co-operation—agriculture, co-operative, veterinary, and public health.

Co-operation with Government Departments.

"Having secured the co-operation of all the above departments, the training classes were started. Mr. R. G. Allan, director of agriculture, U.P., took a keen interest in the scheme.

"It is expected that the teachers, after receiving elementary training in agriculture, will help in rural uplift work by establishing *better-farming societies*, *self-help seed stores*, *fruit-growing associations*, *etc.*, after their school hours."

The association, being itself unable to open farms, due to financial stringency, has succeeded in persuading a number of prominent zamindars in the district to open demonstration farms in their respective zamindaris for the benefit of poor cultivators.

The cotton cess yielded over Rs. 13½ lakhs in the first three years. If you are interested in cotton, you can secure the latest publicity material by writing to the Publicity Officer, The Indian Central Cotton Committee, Bombay.

The problem of existence for millions of peoples in all parts of the world has been reduced to its simplest terms, and amounts to a struggle to escape starvation. This struggle to escape starvation has resulted in widespread movements, in various parts of the world, back to the land.

PRACTICAL HINTS ON VEGETABLE CULTURE IN INDIA

By "Sherrard"

Part 5

Brief Notes on Different Crops

Beans

The application of farmyard manure and the preparation of the trenches for beans have been previously dealt with; and, if these instructions have been faithfully carried out, very little further (attention) will be required besides the usual routine work of cultivation, tillage, watering, etc. The seeds should be sown in moist earth and the trenches saturated with water immediately after sowing all beans. This softens the shell and facilitates germination. In dry soil they may refuse to germinate.

The following fertilizer is recomended for all beans:—

Superphosphate of lime	2 parts.
Sulphate of potash	1 part.
Bonemeal	1 part.

Mix together and apply at the rate of 2 oz. to the square yard, the mixture being dug into the surface soil to a depth of 2 or 3 inches 15 days before sowing. When the plants are about 12 inches high, a little nitrate of soda or sulphate of ammonia may be administered. Mix (by measure) one part fertilizer with four parts dry earth. Work the surface soil loose in the trenches and sprinkle the mixture about ⅛th inch thick over the surface, taking care to avoid contact with the stems of the plants. Agitate the surface, again working the fertilizer into a depth of 2 or 3 inches. The soil should be damp, but not wet, when performing this operation. The next day the surface soil should be watered with a watering-can, and after a lapse of 3 or 4 days the trenches may be flooded in the usual way.

The preparation of the pods for culinary purposes is too well known to call for any description here. The Velvet Bean, however, should first be dipped in scalding water and then scraped to remove the hairy covering before being cooked.

Bean, Broad.—Fruiting period—P. February-March; H. April-May, and July-September. Two classes—Long Pod and Broad Windsor. The former do well, and are easily acclimatized; the latter are not so successful. There is also a Dwarf variety bearing short, narrow pods. Sow late October or early November on the plains as the seedlings cannot stand the heat. Soil heavy, and very rich, which has had an application of lime to which this bean is

Note.— P—Plains; H—Hills.

is partial. When preparing the trenches, they should be filled in to within 6 inches of the top, and the seeds sown in these shallow trenches. When the plants have grown 18 inches high, fill in the trenches to within 2 inches of the top. This is a form of *earthing-up* the plants.

When the plants come into flower, nip off the point of each shoot, or the pods will not "set." *It is the lack of knowledge of this very important operation which dubs the plant as a failure in this country.* These tops may be used as Spinach.

It should, however, be mentioned that, unless the flowers have been fertilized by insect agency or artificially, they will remain sterile, and no pods will be formed. In localities where insects will not perform this duty, an ordinary painter's camel's-hair-brush may be used for the purpose.

Only one or two strong, healthy shoots should be allowed to spring from the base, and all the others pinched off as soon as they grow an inch or two high. Protect from damage by wind by placing two stout stakes at each end of the trench and a few intermediaries to which stout twine is tied so as to keep the plants within the two parallel lines of twine or rope.

Bean, French.—Fruiting period—P. December-February; H. July-October. Rather delicate. Will not stand open, exposed situation. Sow in position which affords light shade throughout the heat of the day, but exposed to the early morning sun. Soil light, rich, and well drained. Method C should be used if sowing is made before the rains are over, a double line on each raised bed. It thrives better on the hills. Does not require staking. Cannot stand frost, and even severe cold brings their career to an end. Plants otherwise healthy, but showing yellow foliage, should be assisted with manure either as a top-dressing or in liquid form.

Bean, Runner (Scarlet Runner and Others).—Fruiting period—P. January-March; H. August-November. Soil should be light, rich, and well drained, but will do well on any reasonably good soil. Runners require stakes 6 feet high; when they have reached this height, the growing tip should be pinched off. Several new varieties of the runner type have recently been introduced, surpassing the old Scarlet Runner in every respect.

Bean, Asparagus.—Fruiting period—August-April. Any reasonably good soil. Several varieties, some grown as field crops (known as Cow Peas), which have smaller pods. The best garden variety has pods 9 to 12 inches in length, and makes quite a good substitute for the French or Runner Bean. Requires stakes 6 feet high.

Bean, Sword.—Fruiting period—September-December. Rampant climber, requiring 8-to 10-feet stakes. Not worth growing

if any of the other beans can be produced. Any soil. The plant is a perennial, and for this reason a few plants grown in some convenient corner will prove an adjunct to the vegetable garden.

Bean, Country.—Fruiting period—September-March, but will not bear if weather gets very cold. Sometimes called Country French Bean. There are sevaral varieties—some with rough pods, some with smooth pods, and others with pods distorted in shape. Some are dark-green in colour, others pale-green, and others red, all sown at the same time and bear at the same time. For this reason it is best to confine oneself to one variety, the variety known as *Makhan sem* being the best, which bears flat, smooth pods of a pale-green colour. As the plants begin to fruit before the European beans come into season, it makes a useful adjunct to the vegetable garden. Any good soil. Requires stakes 8 feet high.

Bean, Velvet.—Same remarks as above. Does not surpass the *Makhan sem* in any respect.

Bean, Goa.—Same remarks as above, but, in addition, bears rather sparingly.

Gourds

All the gourds are greedy feeders; and, though they may be grown in ordinary soil and produce good crops, they readily respond to liberal applications of manure. When richly fed, the crop can be developed to a considerable size. Farmyard and other organic manures are best suited to these crops. Nitrogenous fertilizers applied to the roots by the "sandwich" process during the early stages of growth will considerably help the development of the plants, which, thus being assured of sturdy stems, will produce heavy crops.

The plants' demand for water exceeds their appetite for rich manure; and, unless a plentiful supply of the former is assured, especially during the dry weather, no attempt should be made to grow them. Their greatest need for water is during the growing period, i.e., before they come into flower, after which only sufficient should be given to keep the plants alive.

Most gourds are of a trailing habit. Many varieties will permit of sowings both during the dry and rainy season; others will grow during the dry season only, while others succeed only during the monsoon. The trailing varieties which produce fruit during the dry weather require no staking, and the plants are allowed to trail over the ground; but those that carry their crops during the wet weather require strong support, which should be fixed in position as soon as the plants begin to grow, preferably at the time the ground is prepared for sowing.

The seeds should be sown in moist soil; if possible, no further water should be given until the plants are a couple of inches above ground, when a copious supply should be given; but, should the surface soil dry out before the plants have sprung through, overhead watering with the watering-can will be required daily.

All gourds are the happy hunting-ground of beetles of various kinds. They attack both the foliage and flowers, reducing the plants to skeleton form in a very short time. There is no surer means of ridding the plants of these pests than by hand-picking, which must be continuous. Never wait to see two flies, but take steps to kill the first. All beetles and caterpillars should be rigidly destroyed in this manner. As a preventive, wood-ash freely sprinkled over the plants first thing in the morning, while they are still wet with dew, will deter their attacks. A combination of prevention and eradication should defeat the attackers.

Gourds, such as Pumpkin, Marrow, Cucumber, etc., are not, as a rule, relished by Europeans in this country. This is because they are usually prepared for the table by boiling and served with white sauce; but there are many delicious and palatable ways of serving these, and we need no longer regard them as "tasteless, watery vegetables." A few tried recipes may not be amiss—

CUCUMBER (RAINY SEASON)

2 Cucumbers	1 Egg;
2 Desert spoonsful of chopped parsley;	2 oz. Butter;
½ Small onion;	Rind of half a lemon;
Herbs;	Seasoning.
6 Table spoonsful brown breadcrumbs;	

Cut Cucumbers lengthways, take out seeds, and half cook in boiling water. Chop all ingredients very fine and mix together with raw egg. Fill the centre of Cucumbers with this force-meat, place in dish, pour a sauce over them, and bake for 20 minutes.

BOTTLE GOURD, CUCUMBER (HOT OR RAINY SEASON), PUMPKIN, VEGETABLE MARROW

About 2 pounds of any of the above gourds; 3 tablespoonsful brown sauce; 2 onions; 2 oz. butter.

Peel and remove the seeds from the gourd. Cut in slices. Cut up onion and fry, then fry gourd. Place onion and gourd in stewpan with brown sauce. Heat up, taking care not to break the gourd.

ANY OF THE ABOVE GOURDS

About 2 lb. of gourd;
3 oz. grated cheese;
2 Tablespoonsful brown bread-crumbs;
1 Cooked onion;
$\frac{1}{2}$ Pint White sauce;
2 oz. Butter.

Boil the gourd, line a pie-dish with half of it. Chop up onion, add it and 2 oz. cheese, then place rest of gourd on top. Pour white sauce over all. Sprinkle over with 1 oz. cheese and bread-crumbs. Bake 15 minutes.

Gourds come into the market at a time when there is practically no other vegetable procurable, and for this reason they cannot be disregarded. The varieties of gourds are almost inexhaustible; and, though I have confined myself to but a few, even so the list is a long one.

The following most useful varieties should be grown in order to provide for a succession of vegetables during the hot and rainy seasons:—

Bitter Gourds ...	... For curries.
Bottle Gourds ...	... For stews, curries, baked dishes, and as a cooked green vegetable with white sauce.
Cucumber (Rainy Season)	... For salads.
Gherkin ...	... For salads.
Pumpkin ...	... As for Bottle Gourd.
Vegetable Marrow	... As for Bottle Gourd.
Sponge Gourd (Both Varieties)	For curries and *bhujia*.

Bitter Gourd (*Hot Season*).—Fruiting period—P. May-July; H. July-September. Soil ordinary. All Indian cooks know how to prepare this and the following variety for curries, the only purpose for which they are used.

Bitter Gourd (*Rainy Season*).—Fruiting period—P. September-October; H. July-September. Soil ordinary.

Bottle Gourd.—Fruiting period—May-July and September-November. Soil ordinary. There are many varieties, taking various shapes—some round, some long, some dumb-bell shape, some bottle shape., etc. All are treated alike.

Cucumber (*Hot Season*).—Fruiting period—April-June. Soil ordinary. Both this and the following variety are indigenous. The European kinds can only be grown successfully on the hills. Both the hot season and rainy season variety can be eaten un-

cooked when quite young, but neither has the fine flavour of the European kinds. They, however, make quite a palatable dish when cooked.

Cucumber (*Rainy Season*).—Fruiting period—July-September. Soil ordinary. More like its European sister, both in shape and flavour, than the former.

Gherkin.—Fruiting period—April-June. Any good soil, but a liberal supply of manure will greatly improve and increase the crop. Dwarf bushy habit, small egg-shaped fruit, which somewhat resembles the pickling Gherkin. Superior to both the above in flavour, and more like its European sister. Excellent for salads.

Marsh Melon.—Fruiting period—April-June. Soil sandy, but well manured. Eaten as a fruit.

Pumpkin.—Fruiting period—P. April-June; H. July-October. Rich, heavy soil.

Squash Melon.—Fruiting period—September-October. Light, sandy soil essential. Unlike the Water Melon, it is used as a vegetable, the same as a marrow. Small fruit resembles a medium-sized turnip.

Palwal.—Fruiting period—May-October. Soil ordinary. When preparing the trenches, they should be filled in to within 6 inches of the top, and the plants grown in these shallow trenches. When they have grown 18 inches long, fill in the trenches to within 2 inches of the surface. This is another form of *earthing-up* the plants. May be grown from seed, but the more usual method is by division of roots. They may also be propagated by cuttings during the rains.

Vegetable Marrow.—Fruiting period—P. May-June and August-October; H. July-October. Soil light, well manured. Sow as soon as warm weather sets in—will not stand cold. The rainy-weather crop is not as successful as the hot-weather crop because plants suffer from the rain on the plains, but not to the same extent on the hills.

Snap Melon.—Fruiting period—May-July and September-October. Soil light, well manured. When raw, served as a cucumber, and, when ripe, eaten as a melon.

Spong Gourd (*Ribbed*).—Fruiting period—May-July and August-October. Soil ordinary, well manured. Makes an excellent *bhujia*.

Spong Gourd (*Cylindrical*).—Same as above.

Snake Gourd.—Fruiting period—June-September. Soil ordinary. Fruit cut into strips, dressed and served up like a French Bean. Also used in curries.

White Gourd.—Fruiting period—June-September. Soil sandy;

no manure required if soil previously manured for a preceding crop. Used for making a sweetmeat. May also be used as a Pumpkin.

Water Melon.—Fruiting period—April-June. Soil sandy, heavily manured. Will not stand a damp, moist atmosphere. Eaten as a fruit.

Herbs

A herb is an annual plant, but in the vegetable garden the word "herb" is synonymous with Sweet Herb, and it suggests plants used for garnishing and flavouring.

In the Tabular Statement a number of plants used as herbs have been described. Elaborate details on the culture of all these seem unnecessary here. I will therefore confine myself to the most useful and popular kinds.

It is not generally known that *all herbs can be readily dried and preserved for use.* Proceed *as follows:—*

Pull out the plants by the roots just as they come into flower, shake off the earth, and cut off all the roots, leaving only a stump from which the branches emerge. Wash thoroughly in many changes of water. Hang them on a line, leaves downward, in an airy room or open verandah. Should not be exposed to direct sunlight, otherwise colour and flavour will be lost. When thoroughly dry, strip the leaves and rub into coarse powder the consistency of bran. Bottle for future use. The following fertilizer is recommended for herbs:—

Superphosphate of lime,	...	...	2 parts.
Sulphate of potash,	...	...	1 part.

Mix together and apply at the rate of 2 oz. to the square yard, the mixture being worked into the surface soil an inch deep 15 days before planting. For pot work use 1 oz. to every 6 pots.

When the plants are half grown, a light top-dressing of farmyard manure should be given to the plants, or liquid farmyard manure given at intervals of 15 days.

Marjoram.—Sown in pots and seedlings transplanted to open beds, or to large pots, allowing three plants to a 12-inch pot. Can be grown as a perennial, but on the plains it is better treated as an annual. Also propagated by cuttings during the rains, and by division of roots during the spring months on the hills just before they commence to grow. Soil light.

Mint.—Propagated by division of roots, and replanted annually to fresh ground. Soil somewhat heavy.

Parsley.—In warm weather seeds lie in ground several days before germinating, but in cool weather they germinate a few days after sowing. Soil rich, heavy, and partially shaded.

Sage.—Sown in pots and seedlings transplanted to open beds, or to large pots, allowing one plant to a 12-inch pot. Can be grown as a perennial, but on the plains it is better treated as an annual. Also propagated by cuttings on the plains in November and December, using well-ripened wood. In the hills cuttings are inserted in April or during the rains. Soil light.

Thyme.—Seeds sown in pots, soil consisting of light loam, sand, and leaf-mould in equal parts. Transplant singly into 4-inch pots when an inch or two high, using the same kind of compost, and, when big enough, transfer to larger pots. The plant is too delicate to cultivate in the ground on the plains, but on the hills the plants, after being grown in pots for a year, are transferred to the ground. Soil light, friable, and well drained.

Spinach and Sags

Spinach and Sags should be grown in every home garden because of their dietetic value and easy culture. By growing the different varieties, and by resorting to successive sowings, greens may be made available throughout the year.

Only the larger leaves should be cut when harvesting; this will ensure a second, or even a third, crop. A 1:4 mixture of nitrate of soda or sulphate of ammonia and earth applied to the roots by the "sandwich" process, when the plan ts are half grown, will considerably increase the yield.

Sorrel.—Harvesting period—P. January-March; H. June, September. Cooked and used in same manner as Spinach, but can also be used in salads. Requires partial shade. In the hills the plants grow more vigorously than they do on the plains, and, as a consequence, they should be thinned out to a foot apart. Soil ordinary, but well manured.

Spinach, English.—Harvesting period—P. November-March; H. May-October. Soil light, well manured. Acclimatized seed degenerate considerably.

Spinach, New Zealand.—Harvesting period—P. November-April; H. May-October. Will stand the hot weather far better than the former variety, and successive sowings as late as February on the plains will provide greens right into the hot weather. Method I may also be employed with equal success, and more economically. Soil ordinary. The seed acclimatizes readily, and there is no deterioration for a number of years.

Spinach, Indian.—The most useful of all Spinach because it may be induced to provide greens throughout the year by successive sowings, except for the very hot months and early rains. The European or English varieties are improved strains of this indigen-

ous plant, which is very little inferior in flavour, if at all. Soil ordinary.

Spinach, Sea Kale-Beet (Also known as Swiss Chard). A heavy yielder. Harvesting period—P. November-April; H. May-September. The period may be extended by successive sowings. As the plant develops, the older leaves are used and new ones develop from the centre. A single plant will provide a large number of pickings. Soil ordinary.

Red Spinach.—This belongs to the Amaranthus family, having a red stem and red leaves known as Lal Sag. But there are other varieties of the same formation, varying only in colour, some quite green throughout (Chaulai Sag), and others blotched or veined. A useful adjunct to the vegetable garden because they can be harvested during the hot months and early rains, when there is nothing else in the way of greens. In addition to the leaves, the soft succulent stems are used, cut, sliced, and dressed in the manner of French Beans.

Portulaca-Leaf Spinach.—Harvesting period—P. May-September; H. June-November. A very inferior Sag, though relished by some on account of its slightly acid favour. Also added as a flavouring to stews. Soil ordinary.

Climbing Spinach.—A perennial climber, and, as a consequence, may be harvested all seasons of the year. An excellent substitute for other kinds of Spinach, and should be more largely grown in home gardens. The white-stemmed variety is B. alba, and the red-stemmed variety B. rubra. Soil ordinary.

OTHER VEGETABLES

Artichoke, Globe.—Harvesting period—P. March-April; H. June-August. Soil friable, sandy loam, but will also succeed in heavy soil. The plants will not stand waterlogging, and full exposure to sunshine is necessary. Seeds are sown in pots during wet weather, and in seed-beds after the rains. There is a slight falling off in size of fruit from acclimatized seed, but the plants bear more abundantly. The plants are also propagated by division of offshoots, which may be obtained from the hills during October and November. When once the plants are established on the hills, all further planting is done from offshoots, which do not degenerate in the hills.

They survive with difficulty through the hot and rainy season on the plains. Those that survive should be heavily dressed with cow manure after the rains. Though these will produce an early crop, those raised from seed or from offshoots will produce superior heads.

Saltpetre (nitrate of potash) applied as a top-dressing from time to time is recommended. A dressing of two parts superphos-

phate of lime and one part sulphate of potash should be worked into the surface soil, at the rate of 8 oz. to each pit, 15 days before planting.

Seeds often produce many worthless plants which are not discovered till the flower heads appear; these plants should be rigidly removed; suckers or offshoots will reproduce the same type as the parent.

The flower heads should be cut when half grown. They must not be allowed to mature, except for seed purposes, or they will check further development, and so reduce the crop. The flower stalks should be cut off close to the ground as soon as the picking ceases. If these are allowed to grow, the development of the next year's crop will be retarded.

The plants may also be made to provide Chards, which are preferred by many to Cardoons. This is done by bleaching the stems. The plants are cut down to 4 inches of the ground. The shoots are then blanched when 1 or 2 feet high by tying straw, or preferably roofing felt (as this is not destroyed by white ants) around the stems so as to exclude light. The blanched stems are ready in 5 to 7 weeks.

Artichoke, Jerusalem.—Harvesting period—P. October-February; H. September-October. Tubers or sets are planted 3 inches deep. Soil ordinary. The tubers should not be dug out for storing till quite ripe (January on the plains, and October in the hills), but their delicacy of flavour is best preserved when allowed to remain in the ground and dug out as required.

On no account should the flowers be allowed to appear as this will reduce the size of the tubers. A good plan is to nip off about 6 inches of the tops with the hedge-shears as soon as the buds appear, much in the same way as a hedge is trimmed.

The plant has nothing to do with Palestine, but is a native of Canada. "Jerusalem" is the mispronunciation of an Italian word, *girasole*, meaning sunflower, the plant being in reality a kind of sunflower.

Asparagus.—Not very successful on the plains, the shoots being thin and weak and deficient in flavour. Grows successfully on the hills. Soil rich, friable, sandy, loam and well drained; in heavy soils the produce is practically worthless. As an Asparagus bed will continue profitable for many years, the beds or trenches should be carefully prepared. If necessary, stones, sand, brickbats, etc., should be buried 4 or 5 feet below the trenches to allow for perfect drainage. This is essential on the plains.

The seeds are sown in pots during the wet weather and in nursery beds after the rains. On the hills the seedling plants are

allowed to remain in the seed-beds for a year before transplanting into the open ground. On the plains the seedlings are planted out when they are about 10 inches high. Make no attempt to cut the stems till after the third year, when the plants will have made a strong root-system. Too early cutting accounts for failure to grow good Asparagus.

On the plains top-dress yearly in December with ½ oz. of common salt to each plant, and work this into the soil to a depth of 2 or 3 inches around the roots. This is done in April on the hills. Twice a year, i.e., in October and again in February, apply a top-dressing of decomposed cow manure. If the soil around the plants has risen too high, a depth of an inch or two may be carefully removed before top-dressing with manure. On the hills one annual top-dressing will suffice; this is applied during March or April.

As soon as the young shoots begin to appear, the plants should be copiously watered. In March of the third year a few of the strongest young shoots may be cut for use, allowing the weak ones to grow up. The old shoots should occasionally be cut away.

After the third year a fresh plantation should be established to take the place of the old one, which becomes exhausted after the fifth or sixth year, when the plants should be dug up and removed.

The flowers should be removed as soon as they develop, otherwise the plants will be weakened; but no part of the stems should be removed.

The plants are also propagated by division of roots, two years old to be preferred. They are planted at the same time as advised for seed sowing. Six inches of earth are removed from the trenches and the fleshy roots are spread laterally in the trenches and covered with an inch of soil. As the plants grow, additional soil is moved into the trenches, a small quantity at a time until the trenches are all but filled.

The following fertilizer is recommended for Asparagus:—

Sulphate of lime	... 4 parts.
Sulphate of potash	... 1 part.
Sulphate of ammonia	... 1 part.

Work the mixture into the surface soil in November on the plains and in March on the hills.

Beet.—Harvesting period—P. November-April; H. June-November. On the plains acclimatized seeds are sown before the rains have given over, followed by imported stock in October. The latter cannot stand excessive heat and moisture. The first sowings of the former may be made as early as August.

Avoid thick sowings; the seedlings should not show up closer than an inch apart, and gradually thinned out to the required distance. The best results are obtained by successive sowings every 15 days.

Method A is employed for early sowings to avoid waterlogging during the rains. Method B is employed when the rains are over. When this method is employed, the lines need only be 9 inches apart.

On the hills imported stock is used, and Method B employed as there is no fear of waterlogging.

The soil for Beet should be deeply cultivated and pulverized so as to be free of all lumps and fresh manure; on ill-cultivated land the roots will be deformed. If Beet is to follow a crop that has been well manured, no further manure is necessary. If the land has to be manured, this should be applied a month or two ahead and continuously cultivated.

The Beetroot is a seaside plant; the crop is therefore benefited by an application of common salt. This should be worked into the surface soil at the rate of 1 oz. to the square yard 15 days before sowing. Exhibition specimens are raised by following the instructions given for Carrots; the holes, however, are made 4 inches wide at the top.

Borecole, Kale.—There is little to recommend the cultivation of this form of Cabbage, which, however, does not form a compact head, and should more correctly be classified under Spinach and Sags. It is cultivated for its *greens.* The manner of cultivation is the same as for Cabbage. They require heavy frost to make them tender.

Broccoli.—There are two kinds—the *sprouting* and the *heading*. The latter forms a head similar to a Cauliflower, but smaller, usually maturing the second year, and, as a consequence, can be grown only on the hills. The sprouting Broccoli does not produce a solid head; the edible part is the thickened flower branches which arise from the axils of the upper leaves and stem. Both kinds are cultivated like the Cauliflower (which see).

Brussels Sprouts.—Harvesting period—P. February-May; H. July-September. A most useful vegetable, being productive when there is a scarcity of vegetables. They, however, require heavy frost to make them tender. A partially-shaded situation protected from the afternoon sun suits them best on the plains, when they will continue to bear buttons right into the hot weather. When preparing the beds, a liberal application of cow manure is necessary. When the plants are about 6 or 8 inches high, nitrate of soda is applied to the roots by the "sandwich" process.

Cabbage.—Harvesting period—P. December-March; H. April-November. Early sowings are liable to be destroyed by excessive heat and moisture on the plains. The large drumhead type of Cabbage requires more space than its smaller sisters; 2½ feet apart is a suitable distance to plant the seedlings. On the plains this type may be induced to produce heads, right up to the end of July, by sowing the seed as late as the first week of December, but the resulting crop will produce small heads, and the young plants should, in consequence, be planted only 18 inches apart.

In order to have heads fit for use during the spring months on the hills, seeds are sown in October. The young plants are protected during the winter and planted out in the spring.

The Savoy Cabbage comes to perfection in cold districts, sharp frost being required to make them tender and of good flavour.

The soil should be rich, but not to such an extent as to promote coarseness. When a head of Cabbage has been cut, the stump which is left in the ground will produce two or three small heads fit to be used as *greens*.

Nitrate of soda applied to the roots by the "sandwich" process, when the plants are 6 to 8 inches high, will greatly improve the plants.

Cardoon.—Harvesting period—P. February-April; H. July-October. Plant seedlings in trenches when 6 inches high in a single line down the middle of the trench. Class II method of sowing may also be employed, and answers the purpose more successfully in some places The plant is a perennial, and very similar to the Globe Artichoke. Much relished by French people.

When the plants are nearly full grown, they are blanched. For this task a fine day, when the foliage and soil are dry, should be chosen. Remove the outer decayed leaves, if any, and carefully collect the remainder of the plant into an upright position. Wrap a band of roofing felt around the plant, only the tips of the leaves being left exposed. The blanching will be completed in from 6 to 8 weeks when the white, fleshly leaf-stalks are stewed like Sea Kale. To ensure a succession, all the plants should no be blanched the same day; a few of the more advanced plants are tied up at intervals of every 10 days or so.

Country tiles known as *nullas* may also be used with equal success for blanching.

The old-fashioned method of planting in a deep trench and then filling in the earth to blanch the plants is not to be recommended.

Carrot.—Harvesting period—P. November-April; H. June-September. The cultural notes given for Beet will answer for Car-

rot as well. The produce from acclimatized stock is inferior to imported stock, but nevertheless is not to be despised for early sowing.

If imported seeds are sown as late as January on the plains in some shaded situation, Carrots may be had throughout the hot weather. In this case, the seeds are sown broadcast in small beds; and, if not sown sufficiently thin, the seedlings should be thinned out to 2 or 3 inches apart. Of course the roots will be much smaller than those grown during the winter. They may be taken up as required, beginning with the more advanced plants.

Soot is of great benefit to Carrots. This should first be exposed to the air for three weeks and then dusted on the soil every 15 days after the seedlings are an inch or two high. When cultivating the soil around the roots, work the soil over the roots to keep them covered; this will prevent the "green shoulder," which often spoils an otherwise perfect Carrot.

Fine exhibition specimens may be secured by the following method: Bore holes 8 inches deep and 2 inches wide in the prepared bed at the given distances, and fill these with a sifted mixture of two parts leaf-mould and one part sand. Two or three seeds are sown around the centre of each hole, finally thinning out to a single plant.

Capsicum.—Harvesting period—P. December-February; H. July-October. This is the large-fruited, mild-flavoured variety as distinct from the common pungent chilli. Soil light.

Cape Gooseberry.—Harvesting period, P. December-March; H. March-April. Soil rich, friable loam. When they come into bloom, the growing tips of each shoot should be nipped off. The plants will not endure severe cold, and are not successful at elevations of more than 5,000 feet. Of easy culture.

Cauliflower.—Harvesting period (Acclimatized)—P. November-January; (Imported)—P. January-April; H. April and June-November. Soil rich, friable, and deep. The early maturing imported stock form small heads and are planted 2 feet by 1½ feet apart, whereas the late giant varieties could do with 3 feet each way. To obtain a succession of Cauliflowers from November to April on the plains, both acclimatized and imported seeds must be sown. There are three strains of the former: early, main crop, and late; these strains must be sown each in its correct season. The *early* strain is sown in June, the *main crop* in July, and the *late* in August. If any one of these strains is sown out of season, it will shoot up without forming heads, or the heads will be small and of inferior quality. It is essential that the right strain be obtained and sown at the right time. The beds for the plants from acclimatized seeds must on no account be low-lying for with-

out good drainage the plants will succumb to the heavy rain. When planting in open beds, Method C may be employed to advantage where there is no means of drawing off the surface water. The seedlings should first be transplanted from the seed-beds to raised nursery-beds, and from there to the open ground. Protection should be afforded during the hottest part of the day when in the nursery-beds, and a cool, cloudy day should be selected for planting out in the open. A ball of earth should be taken out with each plant so as to disturb the roots as little as possible. Guard against checking the growth of the seedlings by careless transplanting, and do not allow the plants to get "drawn" before finally planting. Success depends on proper care and the encouragement of strong robust plants, the Cauliflower being the most delicate of the Brassica family.

The plants from imported stock also require great care and attention; but, as they are grown during more favourable weather, they are not so difficult to manage.

The amateur is too apt to blame the seed when the crop is a failure or not up to expectations. The Cauliflower will respond to good treatment, but will as readily succumb to bad treatment. The slightest check from drought, insect pest, poverty of soil, careless transplanting, thick sowing, delay in transplanting, and the planting of weak, drawn seedlings, the result of careless treatment in seed- and nursery-bed, will adversely affect the crop; it is also necessary to observe the rules for Rotation of Crops. The secret of success is to keep the plants in vigorous growth from the day they germinate to the day the flower is cut for the the table. Cultivation at the roots (tillage) should never be neglected. Sometimes severe check in growth will cause the plant to branch, to form inferior beads, or to form no heads at all.

When the flowers begin to show up, a few of the outer leaves should be bent or snapped over the face of the flowers to protect them from the sun to keep them white.

A succession of heads is also obtained from imported seeds; but, in this case, the succession is not obtained by successive sowings; the question is only one of time taken in development. The first early sorts take from 3 to 4 months to mature, the second early strains from 4 to 5 months, the main crop varieties from 5 to 6 months, and some of the late giants as long as 8 months. In some districts where the winter on the plains is a short one it is obvious that the late strains would be of no use. On the hills these late strains are best sown in the autumn, and the other varieties during spring and summer. The earliest heads are from seeds of the early strains sown in autumn and winter under glass and planted out in early spring.

It is a good plan to dress the bed intended for the reception of Cauliflower plants with a light dressing of lime, a month or two before planting, at the rate of ½ a pound to the square yard. When the plants are well established in their beds, about a month after planting out, a 1:4 mixture of nitrate of soda and earth should be applied to the roots by the "sandwich" process.

When there is an excess of Cauliflower seedlings, these should be planted out in some available space to serve as *greens*. The seedlings are planted out 6 inches apart each way, and are cut when about half grown. There is nothing to equal these tops in flavour and delicacy.

Editorial Notes

Men trained in the use of bloodless castrators are required in villages. No villager should be ignorant of the use of a bloodless castrator. Full details can be secured from the nearest officer of the Civil Veterinary Department or by writing this office.

When fodders are plentiful and cheap, the buffalo is the more economic producer of milk and butterfat. Vice versa, when concentrates are cheap and fodders scanty, then the cow is a more economical producer of milk and butterfat than the buffalo.

Modern physical exercises are filtering down to the primary schools as a result of the training of the teachers now being given at the training colleges, where courses of physical training are given for both secondary English assistant masters and vernacular teachers deputed by the boards.

Medical inspection of schools in large towns has been put in the hands of the Public Health Department. Results are satisfactory as far as diagnosis and collecton of statistics are concerned. The treatment of school children, however, is still in its infancy. A good deal remains to be done in the way of spreading the principles of hygiene amongst schoolchildren.

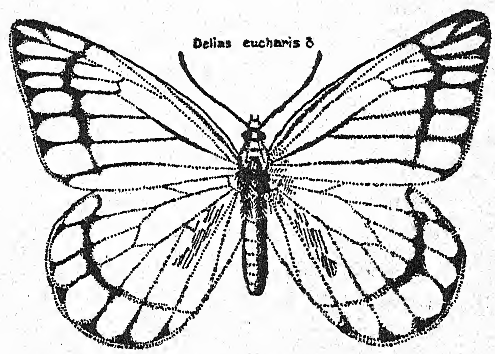
Compulsory primary education in rural areas has come to stay, according to the general report on Public Instruction in the United Provinces ending March 31, 1932. The report further states that the piecemeal introduction of compulsion in small areas is of little use, except for experience of how to work it.

THE WONDERS OF INSECT LIFE

By W. K. Wesley, M.Sc., L.T., Entomologist

Introductory

Man, as a social being, has always been interested in the behaviour of certain insects, e.g., ants, bees, termites, etc., which present excellent examples of a very highly-organized communal life. Poets and statesmen as well as scientists, have drawn parallelisms between the social habits of insects and of man. Apart from their social interest, insects, though they appear to be so small and insignificant, enter most intimately into the everyday affairs of every one of us. We find insects damaging our crops, insects spoiling our furniture and other things made of wood or similar material, insects injuring and devouring our stored products, insects causing great annoyance to us as well as to our pets and other domestic animals; and there are insects which provide us with some very useful products as the result of their activities, e.g., silk, lac, honey, and wax. There are also insects that help us in minimizing our cares and anxieties by utilizing some of the harmful insects as their food, and thus always keeping a check on them. Some insects are the intermediate hosts and carriers of diseases like plague, malaria, typhoid, yellow fever, etc.



That branch of Animal Science (Zoology) which discloses the wonders of Insect Life, including their morphology, anatomy, physiology, habits, life-histories, and all the phases of Insect Life and activities, is known as Entomology. Pure Entomology deals with the morphology, anatomy, physiology, life-histories, classification, evolution, distribution, and palæontology. Applied Entomology is the application of this knowledge of insects to human affairs with a view to make this world a better place to live in. It lays emphasis on the study of habits, life-histories, and distribution of insects in order to find the weak spots and effect the control measures right there.

(To be continued)

THE DEMONSTRATION FARM

In the development of demonstration farms in India by Government, by colleges, and by large landowners too much emphasis in the past has been laid upon purely Western ideas and methods.

"Demonstration" farms, with their tube-wells, pukka water-channels, pukka roads, irrigated crops, tractors, farm machinery, pukka godams and farm buildings, well-fed cattle, sheep, goats, and poultry; office, supervisory, and menial staffs, have produced a profound *"pyschological"* effect on the ryot and the cultivator who visit and see one of them.

The "psychological" effect produced in the main is one of helplessness, hopelessness, and despair at the impossibility of ever being able to afford to do the things demonstrated to them.

This "deleterious" psychological effect on the mind of the "ryot" has been observed, and practice has been accordingly modified in the United Provinces. The Director of Agriculture, Mr. R. G. Allen, has, we are informed, started a new type of demonstration farm that, we feel sure, will meet with success.

The new type of *demonstration* farm will not introduce any complicated newfangled ideas to the ryot. If there is a tube-well in the area, then the demonstration farm will have one; otherwise not. In the same way the entire practice of the area will be used as the background upon which to build up and demonstrate "improved" *methods;* and the progress will be gradual and in keeping with the capabilities of the ryots. The demonstration farm will be run on a business basis.

Agricultural college farms will be run along purely experimental and research lines—not along purely commercial farming lines. Ryots will not be encouraged, nor expected to visit the college farms; they will visit the *demonstration* farms. The demonstration farm will not experiment; it will demonstrate and extend the results of research secured from the agricultural college of the area.

For the present agricultural colleges may serve as experiment stations, but at a more advanced stage many experiment stations will be required in the U.P. and other provinces to meet the need of particular soil and climatic conditions.

Landowners who are thinking of starting a "demonstration" farm should communicate with the Director of Agriculture, U. P., Lucknow.

"Vegetable culture to be successful must be regarded as a purely business enterprise."

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EDITORIAL

The Supreme Discovery of the Ages.

To-day, probably more than ever before, the world is becoming more conscious of the old adage which goes: "God helps those who help themselves"; and, as a result, there has been a corresponding shift in the view with which man has regarded himself and the world of natural phenomena in which he lives, moves, and has his being. This view can best be summed up in the words of one of the greatest living scientists, and without doubt the most noted physicist—Professor Robert A. Millikan—who says: **"The supreme discovery of the ages is that the universe is governed by law and not the caprice of a deity."** All that we know about astronomy, geology, physics, chemistry, botany, agriculture, or about any of the sciences is the result of the discovery of this all-encompassing truth.

In the early days of mankind there was no conception whatever of universal law. They thought of all the forces of nature as persons who acted according as their desires or whims swayed them—sometimes malignant and sometimes benevolent. The early races of mankind put persons everywhere. There was a god of the year. Day and night were deities. The dawn, a goddess, led forth the dance of the rosy-fingered chariot wheels across the solid roadway of the sky; and at night the moon, "pale goddess," ruled the dusky hours and led out the stars for their night-long choral song. The wind and the clouds, and the light and the sky and the rivers and the seas, and the trees all had their god or goddess. Nothing was supposed to occur according to fixed and incalculable order. All was practically a gamble because no one knew beforehand—except as they sometimes thought they knew by oracle or prophecy—what any particular god might conclude to do. This was the condition of thought throughout the so-called pagan world, and which has not disappeared even to this particular day.

The first great triumph of law was in Newton's discovery of the law of gravitation. Of course, this phenomena existed before a

law was formulated with regard to it, just as at the present day many various phenomena exist which we do not understand, and with regard to which laws have not been formulated. As a result of Newton's discovery, astronomy is to-day the most exact and fascinating of the sciences.

It has been because of the discovery and consciousness by men that "the world is governed by law" that men have set themselves the task of *finding out these fundamental laws of nature, and that is the purpose of every science.* As nature has yielded up her secrets to the minds of men, the ancient panorama of myths, deities, and superstitions has grown dim and largely faded away.

Our railroads, steamships, automobiles, aeroplanes, telegraphs, telephones, radio, television, the humming wheels of our factories are all based upon, and made possible by, the discovery and consciousness of that great truth.

It is this truth, more than any one thing, which to-day calls for a readjustment of our thinking in all lines of thought. It is also probably due to the lack of this adjustment between modern knowledge and our customs, habits, and traditions of the past that there exists so much confusion of thought to-day. This is particularly true of customs and habits which have a socio-religious-economic sanction. This is the kernel of the problem which faces the rural sociologist, economist, and rural worker. **The old socio-religious-economic customs and habits are in need of a reinterpretation and adjustment in the light of present-day modern knowledge and the needs of present-day society.**

* * * *

A Stable Currency is the Greatest Need of the Present Day.

"The United States seeks the kind of dollar which a generation hence will have the same purchasing power and debt-paying power as the dollar value we hope to attain in the near future"—so declared President Roosevelt in this massage to the World Economic Conference.

In their book, "Prices," recently published by Dr. Warren, in collaboration with Professor Frank A. Pearson of his department at Cornell, the authors adocate—

"An all-commodity dollar, rather than a one-commodity dollar. Dollar same value at all times. Independent of business cycles.

"An all-commodity dollar would do much to eliminate the nightmare of unfavourable balance of trade. A country could adopt a compensated dollar without waiting for an international

currency. Such a money would enable one to borrow with a definite knowledge of what repayment means."

Dr. Warren's theories have been summarized by the *Land o' Lake News* as follows:—

(1) When gold is used as the standard, the value of all currency and bank-deposit money is tied to that metal. The price of any commodity therefore is the ratio of the supply and the demand for that commodity to the supply and demand for gold;

(2) As long as the world's supply of gold increases at about the same rate as the world's physical volume of basic-commodity production, prices expressed in terms of gold-standard currencies tend to remain steady. If gold outruns production prices, rise; if it lags behind, prices fall;

(3) When nations go on or off the gold-standard, prices are influenced. During the war most of the countries went off the gold standard; that is why prices rose so high. Following the war, the countries took steps to get back to the gold standard. That is why prices have dropped so low.

(4) After prices and wages become adjusted to the price-level, any rise or fall, especially a fall, causes serious trouble; and

(5) A scientific measure of value is a dollar (or a rupee) that has a constant buying power not for one commodity such as gold, but for all commodities at wholesale prices. This can be done by instructing central banking authorities to change their buying and selling prices of gold as they now change their discount rates, as often as is deemed necessary, based on the price-level of a group of commodities.

* * * *

A Silo Pit is within the Reach of the Villager.

The need for proper storage of fodder for India's many cattle returns to mind with the approach of the harvest season. Large amounts of fodder are harvested and stored as dry fodder to be fed during the winter. This is a comparatively poor feed, little relished by the cattle, and giving low food value to them.

Silage has long been recognized as a splendid way of preserving a high-grade fodder. Grass, juar, bajra, maize, and many other things have been successfully used for making silage.

Expensive Silos Are not Necessary.—In the deep soils of the Ganges valley deep circular silos can be made below ground-level. Almost everywhere trench silos are possible. According to the last year-book of the United States Department of Agricul-

ture, 1932, trench silos have been successfully used for a single animal, and are easily managed for four or five. Successful silos have been also made of bundles of fodder. Something along this line should be tried in India.

It is not necessary to chaff the fodder or grass first. If the bundles of fodder or loose stalks are nicely arranged so that they pack well, they may be put in without chaffing. Grass bundles should be opened, and the grass evenly spread. Fodder should be chaffed before feeding as this reduces waste. Daily requirements can be chaffed with a small hand chaff-cutter for a small herd. Small power-driven cutters are available where daily chaffing is required.

* * * *

Pneumatic Tyres for Farm-carts.

The application of pneumatic tyres to all sorts of vehicles is being repidly developed. Their use became general about 30 years ago for motor-cars and bicycles. Fifteen years ago they were successfully applied to lorries and trucks. Within the last two years they have been successfully applied to farm tractors, wagons, and even bullock-carts. Wherever they have been applied, they have resulted in economy.

The application of such tyres to tractors has resulted in economies of about 25 per cent in fuel consumption, and increases of nearly 30 per cent in the work accomplished in a given time. The comfort of the operator is also increased greatly.

* * * *

Sugar-cane Growers, Note!

Recent tests with the Wah-Wah cart built in the Institute Workshop and equipped with Dunlop tyres are of interest to all carters, and especially to sugar-cane growers. A very good steel-wheeled cart in use for several years at the farm of the Institute was able to bring 60 maunds of fodder from the field in which it was grown with two heavy buffaloes pulling it. The same buffaloes pulling a four wheeled wagon were able to bring 80 maunds from the field. The Wah-Wah cart, with the same buffaloes pulling it, brought 133 maunds. These figures were not for loads carried on metalled roads, but from the field in which the fodder was grown; and the tests were made in early September when the ground was soft from rain.

Present indications are that, within a few years, anything but rubber tyres will be obsolete.

Control of San Jose Scale.

The use of a "Lime-sulphur" spray by fruit-growers in the United States America for the control of San Jose Scale and pear-leaf blister-mite is reported in the United States Department of Agriculture *Farmers' Bulletin* No. 1285. Directions are given for the making up of home-made preparations.

* * * *

What is the Value of Commercial Fertilizers?

It will be remembered that in the September number of *The Allahabad Farmer* (volume VII, No. 5, pages 201-2) three definite trends in the improvement of agricultural practices were pointed out—

(1) the appreciation and use of the improved varieties of seed now obtainable from the United Provinces Department of Agriculture and other farms;

(2) the slow, but steady, replacement of the comparatively inefficient desi plough by new types which open up the soil more satisfactorily; and

(3) the increasing attention paid to manuring of the crops with both organic and inorganic fertilizers.

These are trends of agricultural improvement to be noted in the United Provinces. In some areas these trends may be more noticeable than in others. To what extent are these trends or changes in agricultural practice simply based upon trial and error methods? To what extent are "experimental" results secured at Pusa, Cawnpore, Lyallpur, etc., applicable to the various areas of such a large province as the United Provinces? It is being increasingly recognized that "experimental" results of any one area are not "absolute" values which can be obtained in other areas, except under identically similar conditions. Fertilizer experiments conducted at "Cawnpore" or "Allahabad" can hardly be taken as representative of the results which a ryot may hope to obtain in any of the provinces without regard to *soil heterogeneity*, seeds, climatic conditions, and various factors of management.

"Experimental" results, to be of definite value, must be necessarily applicable to large areas. This calls for the careful location of "experimental" and "demonstration" farms in areas possessing at least a certain representative "soil heterogeneity" and climate. The "experimental farm" should be representative of the soil area which it should represent. It is expecting too much to assume that "experimental" results of one or two localities of the provinces, or that the agricultural practice of one part of the provinces, can be applied holus-bolus to all parts of the provinces. They may, or may not!

The statement appearing on page 202 of the last number of *The Allahabad Farmer* to the effect that "the most effective and the most popular of the concentrated inorganic fertilizers in these provinces are sulphate of ammonia and nicifos" was not based upon "experimental" data in the recognized meaning of the term, but was based upon the fact that cultivators have made practical experiments, have increased their purchases of these fertilizers in recent years, and have increasingly used them in the cultivation of vegetables, potatoes, etc. The cultivator is notoriously conservative, and the fact that he is willing to pay for "fertilizers" indicates that they have an economic value for him.

The fact, however, remains that the use of fertilizers will increase as time goes on; and the public needs to be protected from possible "exploitation" by fertilizer companies. Fertilizers need to be "vetted" by some competent and disinterested party. They should be sold on a definite guarantee as to their chemical composition. The chemical composition should be stamped on each bag so that the purchaser can know what he is getting, and so that the State chemist can check up on the fertilizer in order to see that the consumer is getting what he pays for.

With regard to nicifos the statement is made by the agents that "there is no *definite* evidence that phosphorus increases the yield or improves the quality of the vegetables in the United Provinces; but it is maintained by them that the use of a certain amount of phosphorus every year, or at any rate at regular intervals, is sound agricultural practice inasmuch as there is a very great risk that, if nitrogen alone is added to the soil year by year and the bigger crops resulting therefrom are harvested, the balance of plant-food in the soil will in due course be upset, and it will be found that the nitrogen no longer gives the same result as before. In such cases, it has been found that this is definitely due to lack of phosphorus in the soil, and the addition of a phosphate fertilizer has enabled the nitrogen once again to give its full effect. It is for that reason therefore that we invariably recommend the use of nicifos which contains 18 per cent nitrogen and 18 per cent phosphoric acid as the basic dressing, with sulphate of ammonia normally recommended as a top dressing." [Nicifos is the trade name of the fertilizer sold by Imperial Chemical Industries (India), Ltd. Their advertisement appears on page VII in the advertising section.]

A correspondent writes that the arguments regarding the use of phophorus are far from convincing to him. That is as it may be. It is not a closed question by any means. It will be clear that there may be soils which do not need phosphorus, but which after some years of heavy cropping would need it. We agree that "the logical thing would be to apply the phosphorus when the need

arose." There may be also many soils in which there would never be this need of phophorus, especially if manure in the form of dung were used.

A question arises, which, it is hoped, will be taken up by disinterested parties, as to whether phosphorus can best be applied to the soil in the form of nicifos? A comparison of these fertilizers—sulphate of ammonia and nicifos—with sodium nitrate ($Na\ NO_3$) would also be of great value. The fact that the cost of $Na\ NO_3$ from Peru during the past two or three years has not made its use economical when compared with sulphate of ammonia and nicifos, does not preclude its use because "there is the possibility th at synthetic $Na\ NO_3$ will be on the market in the fairly near future.

The sale of the commercial fertilizers in India has increased considerably during the past few years. As the commercial field expands, more products will enter the market; and, unless the sale of fertilizers is made by honest agents and controlled by Government regulations, exploitation of the ryot is likely to occur.

At the present time it is very doubtful if "fertilizer experiments" carried out in any area, except in the area where they are to be sold and used, will carry any great weight with the cultivator! These "fertilizer experiments" under practical conditions in the area—vegetable and potato—should also be carried out by disinterested parties, and not by agents of the selling company. No doubt in the area—vegetable and potato—there are many farmers who are increasingly making more use of commercial fertilizers, and who have had good results. **We should like to hear from these farmers as to their experiences with commercial fertilizers.**

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Review of Agricultural Operations in India, 1929-30 and 1930-31.

The publication referred to in the margin is issued under the authority of the Imperial Council of Agricultural Research, and may be obtained from the Manager of Publications, Delhi, for Rs. 5.

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Fodder Crops.

In Bengal, the Second Economic Botanist and the Live Stock Expert have done much valuable work on fodders. Napier grass (Elephant grass: Pennisetum purpureum) was the heaviest-yielding of all the fodder

crops tried. It is perennial, and is propagated like sugar-cane. Grown without irrigation, it gave 881 maunds per acre against 441 maunds from Guinea grass (Panicum jumentorum). Under irrigation at the Dacca Sewage Farm Napier grass gave 3,000 maunds per acre against 2,000 from Guinea grass. It seems possible that Napier grass will make an excellent permanent crop for a cultivator to grow near his homestead to furnish a perennial source of nutritious green-stuff throughout the year.

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A Cheap Substitute for "Flit."

Snowflake oil	... ...	60 oz.
Pure carbolic	... ...	$2\frac{1}{2}$ oz.
Creosote ...	... ...	1 oz.
Citronella ...	... ...	1 oz.

* * * *

Sulphuric Acid as a Weed-killer

In a recent issue of *Nature* (July 22, 1933) there is an interesting article on the use of sulphuric ac.d for the destruction of weeds on a field scale. Pioneer work in this direction was conducted by Rabate in France in 1911. The method has now become very popular, and in 19 1 about 27,000 tons of this substance were used for weed-killing purposes in France, whilst some twenty French manufacturers produce suitable spraying-machines for its application. It is also gaining ground in England; and this summer several thousand acres have been sprayed with uniform success, and the farming fraternity has evidenced a considerable interest in the novel process. The method of application consists in first mixing the commercial brown oil of vitriol with water to give a 7- to 10-per cent solution, and then spraying it over the land from a suitable machine, either horse- or motor-drawn. About 100 gallons of the liquid are required per acre, and may be increased to 150 gallons according to the condition of the field. The cost of spraying is 12s. 6d. to 15s. per acre, depending upon the acreage treated. The actual benefit of spraying is claimed to be as much as £2 to £3 per acre in the most favourable cases.—*Reprinted from "the* Nagpur Agricultural College Magazine," *volume VIII, No.* 1, *page* 43.

How many of our readers followed our admonition to plough their garden plot to a depth of one foot before the Monsoon?

PISCICULTURE

By the Director of Fisheries, Madras Presidency

Introduction.

Fish culture in ponds is a very ancient industry.—It is probable that the Chinese were the first to practise it on a large scale, and even now they are among the most skilful pisciculturists in the world. The earliest pisciculturist of China is said to have lived in the 5th Century B.C. The ancient Romans had their fish-ponds, and fabulous sums were spent on their upkeep. In Europe, in the Middle Ages, every monastery and every manor had its fish-pond. In Central and Southern Europe large farms and estates, and even hotel gardens, still retain their fish-ponds. In Germany fish culture is practised on a very large scale, and farms are run on a commercial basis. Some of these fish farms may be as much as six or seven thousand acres in extent. "In Austria a derelict canal-bed is used by the largest establishment for its ponds. In Italy the controlled waters of an eel farm are many miles in length." Fish farmers in France, Switzerland, the Netherlands, Austria, and Italy have Government research stations to help them, while in Russia great attention is now being paid by the Soviet Government to research work on all branches of fisheries science, including methods of increasing production from carp-ponds. In America also fish-ponds on farms are common. The Government supplies farmers with fry, and also gives information for successful cultivation. In China also the cultivation of carp fry in ponds is an important and ancient industry. Immense pains are taken to transport the tiny fry, caught in the river, to nursery-ponds in places often some miles away, where regular markets are held. From China there is a regular trade in carp fry with the Philippines, Singapore, and the East Indies. The little fishes may have to travel as long as 16 days in tubs, and four men are required to keep the water aerated and look after the fish in each set of tubs.

Japan is another progressive country where fish culture is an old and important industry. The skill of the Japanese in breeding gold-fish of fantastic shapes and beautiful colours is well known. Their paddy-fields are used for growing large numbers of carp. In addition, many other varieties of fish and aquatic animals are cultivated, and even the foreshore is parcelled out into plots for the culture of oysters, and other shell-fish, bêche-de-mer, snapping turtles, etc. Marine and estuarine fish are cultivated in backwaters in Japan. In 1907 it was reported that in the neighbourhood of Tokyo abont 225 acres of ponds were devoted solely to the culture of carp, supplying the city with more than 400,000 lb. of fish anuually.

The Fish Industry is Important.

These examples serve to show how ancient and important an industry fish culture is, especially in those countries where large acres of land make the distance from the seashore and centres of sea-fish supply very great. It will be noticed, however, that, even in progressive countries with rapid communications and modern preservative methods of transport, it is still considered worth while for Government to encourage and support fish culture; and fish farms are a commercial success.

How much greater should be the need and the opportunity for such an industry in a sub-continent such as India, where communications are wholly inadequate and distances prohibitive; where modern methods of transporting fresh food are practically unknown, and the climate such as to make putrefaction much more rapid than in temperate regions; where the majority of people are non-vegetarian, and only too glad to eat fish if they can obtain it.

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Fish in the Diet.

The poor diet of a large proportion of the population, particularly in the rice-eating areas, has begun to engage the attention of all those who are concerned about material health. The coming of milled and polished rice has robbed the staple food of many people of its most valuable qualities. The addition of fish-food, if it could be made available, would go far to correct the deficiency and make a more balanced diet. It is claimed that fish is the best corrective to a rice diet. There are many other people also who would welcome fish for the sake of variety, and for the value which they know it to possess as a food. It is the purpose of this article to show tha **fresh fish is within the reach of almost every agriculturist**, and that it is as profitable a crop to raise as any other. Since water is absolutely necessary for the cultivation of any land crop, a small amount of labour and a nominal expenditure will, in all probability, be sufficient for the farmer to add a valuable source of food-supply to the family menu, and possibly, in addition, supply him with an extra source of revenue. Before studying in greater detail the position of the fish trade in India it will be interesting to see more closely how the commercial fish farms of Germany and Japan are worked. The methods in both cases are very much the same, and a careful study is likely to yield valuable lessons for the Indian agriculturist. The following account is taken from Sir F. A. Nicholson's description of his tour in Germany about 1907. In the numerous peasant holdings of Bavaria the farmers grow crops of cereals of fish, mostly carp. In fact, one farmer is reported to have said that his fish-pond was more profitable than an equal area of dry land. The ponds are

purely natural drainage-ponds, and throughout the winter they lie nearly empty so as to kill off noxious animal life and useless vegetation. Periodically, say once in ten years, or even oftener, the ponds are kept dry throughout the summer and cultivated, when they produce a heavy crops of oats. During the winter a quantity of the pond mud is dug out and used to manure the land. The fluids from the cow-sheds are drawn off and conveyed by a pipe to the main pond to promote the growth of food for the fish. In fact, the ponds, are manured as carefully as the land; and, as the ponds receive the drainage from the fields, which are all manured, a good deal of the manure is used indirectly by the fish, instead of directly by the land. The ponds are usually situated in low-lying land too wet for ordinary crops. Kitchen refuse is also used as auxiliary fish-food.

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Cultivating Fish.

In April or May a few adult fish, usually one female to two, three, or four males, are placed in small breeding-ponds. The eggs may be removed or the fry allowed to hatch. If the farmer has no spawners, he can buy them, or the ova or the hatched fry. In addition to the trade in fish for cultivation, there is a regular trade in containers for transport spawners, ova, or fry. When the fry are a fortnight old, they are removed to the main pond. This is necessary to prevent the parent fish from eating the fry, and also to give the fry both food and space sufficient for their growth. By November they have reached the fingerling stage, and are kept in deep wintering-ponds. At the end of the third summer they weigh $2\frac{1}{2}$ to 3 lb., and are then sold. After this age they become coarse. Spawners may be kept up to ten years for breeding purposes. Although the price was low at the time, the farmers were able to make a profit. The average return was about 110 lb. of fish per acre. One farm was producing 125 lb., worth, at that time, Rs. 60 per acre. The expenses are very small. In India the returns are very much greater, as will be shown hereafter. Carp respond readily to high feeding, and it has been found by actual experiment in Germany that a 3-year-old carp can be made to triple its weight in the summer.

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The Practice in Japan.

In Japan carp and eels are largely cultivated. In certain localities young carp, when 1 or 2 inches long, are placed in the paddy-fields in June, when irrigation begins. By October, when the paddy is cut, they have grown to 8 or 10 inches, and are marketable. The fry for this

purpose are distributed gratis. The rearing of the fish is said to improve the crop since the fish destroy many insects injurious to the plants. Should the water fail, the farmer digs a small pit in a corner of the field where the fish may take refuge until more water comes down. In one village, where the agricultural society represents the whole village, it was declared that 250 acres of paddy land are used yearly for fish-breeding, raising annually twenty-five million fry to be sold and raised in surrounding villages. In another district a vast area is irrigated by inundation, and the culture of carp in this area in 1902, when the industry was in its infancy, realized no less than Rs. 72,000.

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Regular Fish Farms.

Besides the utilization of paddy-fields for fish culture, there are the regular farms, such as those near Tokyo, already mentioned. Here the fish—both young and old—have to be fed as the ponds are small and contain little natural food, while the fish are crowded into them in large numbers. In some districts the pupæ of the silk-worm, after the silk has been removed, is the principal food. Fish so fed need a special feeding course before marketing. The utilization of a waste product, such as the silk-worm pupæ, for feeding-fish, no less than the additional food-crop obtained from the paddy-fields by introducing fry into the water, is a striking example of how the Japanese waste neither space nor material. Carp, eel, and mullet are frequently grown together. The yield from these ponds, according to the figures given, seems incredible, but is by no means impossible. Properly-fed carp will grow to 20 inches within two years. Sir F. A. Nicholson visited three farms near Tokyo—one belonging to the Fisheries Society, and two others to business firms. The area of the Fisheries Society's farm was only 7 acres, with three large ponds covering nearly 6 acres used for growing fish for market. The remaining area was divided into 11 small ponds for breeding, experimental, and other purposes. The three ponds were said to have produced in the previous year more than 20,000 lb. of eel, 23,000 lbs. of carp, and a large number of mullet; that is to say, the yield was more than 8,000 lb. of fish per acre. Another establishment produced 1,800 lb. of carp per acre, and probably an equal amount of eel and grey mullet would be grown simultaneouly in the same ponds. Very large yields have also been obtained from American ponds where cheap artificial food was available.

Fish Culture as an Industry in India.

It will be seen from what is being done in other countries that fish culture in ponds is no new thing, and that merely as a by-product it may add considerably to the wealth of the agriculturist. In India this industry is almost non-existent, and the question to be considered is whether there is scope for such an addition to the farmer's resources. The first requisite is, of course, water suitable for fish culture. It will be seen that the water need not be permanent for the farmer at least to fatten a few fish for his own use, provided he can buy fry at the beginning of the season. Apart from the big tanks, there are many available water areas which are now either growing a few wild coarse fish, or merely form breeding-places for mosquitoes. Just below a tank bund there is often a marshy area too wet for crops which could, with little labour, be converted into small ponds. There are the paddy-fields themselves. Above all, there are the innumerable village-ponds, wells, and tanks which could be stocked co-operatively by the villagers, and the even larger numbers of private wells and ponds belonging to individual farmers and landholders. Permanent wells and tanks can be used for breeding and rearing fry for distribution to non-permanent waters, as well as for growing marketable fish. All water used for fish culture must, of course, be controlled to prevent the entrance of predacious fish and the escape of the cultivated fish. Artificial feeding would probably not be required to any great extent. Carp are omnivorous, and will eat damaged cereals, kitchen refuse, and other things that would otherwise be wasted. In silk-producing areas, as in Japan, the pupæ can be used after the silk has been wound off. In tropical countries the introduction of suitable vegetation will probably bring in its train a sufficiency of material food, while ponds used for washing cattle, drainage areas of farms, and irrigation waters from cultivated land are likely to be abundantly rich in the tiny organisms upon which the fish feed. Where the water is too shallow and dries up in the hot weather, a little labour may be expended year, by year in the slack months, in deepening the pond, the mud being removed to the cultivated area to enrich the soil. An occasional crop grown in such a place should yield good results, besides improving the fish crop for the following year. The use of sheep-droppings or cattle manure, which are available to every farmer, will provide an abundance of fish-food at no extra cost. A survey of the neighbourhood is likely to reveal plenty of water-area which, with a minimum of labour and expense, can be utilized for raising a crop of fish.

Suitable Fish for Rearing.

The next question to consider is the availability of suitable fish for rearing. The old stew-ponds of Europe were mainly stocked with carp, and this is the chief fish now grown in China, Japan, and America. It is estimated that 60 per cent of the freshwater fish of the Madras Presidency at least belongs to the carp family, and this proportion holds good in other parts of India as well. In the warm waters of the tropics this fish grows at a tremendous rate, reaching a marketable size in three or four months. It also has the merit of being hardy and easily reared, while the young fry can be transported considerable distances. The farmer who has only a small temporary pond can therefore obtain some fry each year with little trouble or expense to at least supplement the food-supply of himself and his family, with resultant benefit to their general health, while the farmer with a larger area and permanent water can raise his own breeding fish, and needs only the initial outlay for some good spawners.

The following fish have been found suitable for cultivation in ponds in the Madras Presidency:—

1. **Catla.**—This is a large carp found originally in rivers and tanks north of the Kistna River in the Madras Presidency. It is also found in all the important rivers of North India. Since the construction of the Cuddapah-Kurnool Canal, it has found its way into the Pennar River in South India and its connected tanks. It attains a maximum length of 6 feet, but is usually eaten when not exceeding 2 feet. It is a very hardy fish, and can be transported long distances by road or rail. It does not breed in confined waters, and therefore young fish must be collected from the rivers and transferred to ponds. Experiments show that fish of 2½ inches grow to 1 foot 4 inches in ponds and wells, without artificial feeding, in the course of 6 months. It is this phenomenal growth which makes catla the most useful fish for cultivation in non-permanent waters. Catla fingerlings, with instructions, are supplied to the public by the Madras Fisheries Department at the cost of Rs. 5 per hundred, exclusive of transport charges.

2. **Gourami.**—This is the most highly esteemed of all fresh-water fish for the table. It was introduced into Madras from Java and Mauritius. Its large size, bonelessness, and delicate flavour, and the ease with which it is bred and transported, render it easily the best fish for pisciculture. This fish is purely a vegetable feeder and breeds twice a year, building a nest in the weedy margins of the pond; a tiny small permanent pond with a depth of 3 feet is admirably suited for this fish. The fish breeds best when about 3 years old. Adult fish in breeding-ponds may require artificial food. This fish grows to 18 or 20 inches,

and attains a weight of 20 lb. It breathes air, and so travels well over long distances if consigned in special cans filled with water. Young gourami are supplied by the Madras Fisheries Department from the fish farms in Kurnool, Nellore, North Arcot, and Chingleput at Rs. 10 per dozen. For gourami, of course, only one initial expenditure is required since young fish will be available after 2 or 3 years in the pond.

3. **Etroplus.**—This is a backwater perch found along the coasts of the Madras Presidency which readily adapts itself to fresh water and breeds in tanks and ponds. It grows to upwards of a foot in length, is free of bones, and has a good flavour. It is a good sporting fish for anglers. The fish breeds twice a year, but if the pond has a muddy bottom it requires submerged stones or other hard materials for attaching its eggs. Etroplus will breed freely in ponds 2 to 4 feet in depth. Fry of this fish also can be obtained from the Madras Fisheries Department at Rs. 5 per hundred fish.

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Fish Culture in Ponds and Tanks.

These are examples of varieties of fish best suited for culture in ponds and tanks. There is a number of other kinds, such as varieties of barbus and labeo, which could be easily obtained in the breeding season at small cost from local fishermen. Before starting fish culture on any large scale it would be necessary to make a careful survey of the waters of the neighbourhood, and of the fish locally available. Experiments will then show which are the most suitable kinds for pisciculture in any area. In addition, it may be necessary to pay some regard to local prejudices and tastes; and, if marketing the fish is contemplated, to the prevailing prices and general economic conditions.

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A Madras Experiment

An experiment was made in 1931 by the Madras Fisheries Department to introduce pisciculture as a subsidiary occupation in rural areas. Unfortunately, a policy of retrenchment compelled the abandonment of the scheme, and the special staff was disbanded. Enough experience was gained, however, to show how useful an addition pisciculture can make to the country's wealth. As early as 1881, Mr. H. S. Thomas, of the Madras Civil Service, conducted an experiment in the

Vallom tank in the Tanjore District. When the tank became dry, he had it cleared of all predacious fish. He then introduced only 2 lb. weight of fry of selected non-predacious fish, namely, labeo, barbus, etc. After 18 months these 2 lb. of fry yielded 4,000 lb. of fish, and was then not exhausted. Subsequent years gave a much higher yield. At Chingelput, in 1930, a small well in the compound of the R. C. Mission school was stocked with 28 catla, varying in size from 3 to 5 inches. These fish were actually introduced on the 7th September, 1930. On the 8th December, 1930, two catla were caught measuring 9 and 11 inches respectively. In other words, the fish had grown 6 inches in 3 months without any special feeding. On the 19th February, 1931, a second trial fishing gave fish varying from 10 to 14 inches. A third trial fishing 8 months after the introduction of the catla into the well showed that they had gained a foot in length during this period. The astonishment of the owner at this result may be imagined, and his enterprise in allowing his well to be used for the first experiment in that district was well justified.

Fish farming, *on these lines,* would go far the improve the diet, and therefore the health, of the people, and might well prove a useful source of income both for the private agriculturist and landowner, as well as for village panchayats, co-operative societies, local boards, and such other public bodies as have tanks and wells under their control.

For millenniums, long before the ages of which we have reliable records, poultry have provided a supply of food for mankind.

"In academic centres science was fighting the humanities for its place in the sun, and it was during this era that there came into being that new species called the "pure scientist," unsullied and untouched by practicality, but willing enough to use the public moneys, appropriated so that science could render more productive and remunerative the basic industries of the nation. It is well to remember that the scientists who have written their names across the pages of history have been those who have advanced mankind and relieved humanity of its burdens. They are honoured in direct ratio to the advancement civilization has received from their discoveries. *All science is pure: it matters not whether it is digging into the sewers of a great city, or studying the elusive perfume of a spotless lily."—From the Presidential Address of T. H. McHatton at the Annual Meeting of the American Society for Horticultural Science, December,* 1931.

THE CASE OF PROTECTION TO THE SUGAR INDUSTRY IN INDIA

By Kripa Shankar Pathak M.A., (Economics)*

Short History of the Sugar Industry.—It is believed that India is the original home of sugar-cane. The sugar-manufacturing industry can be traced back 25 centuries. The cane cultivation and manufacture of raw sugar (gur) was carried on by the cultivators themselves, as is done even now. Until the discovery of beetroot-sugar cane-sugar was the sole source, and India exported raw sugar to Britain in large quantities. European planters planted cane in the West Indies and Mauritius, and encouraged production by trade restrictions and import duties. *The import of foreign sugar in consequence began in India in* 1850. There was a sharp rise in imports in 1896 due to a further influx of European beet root-sugar, freely helped by prohibitive import duties on foreign sugar and bounties on exports which entirely changed the character of the Indian sugar trade.

Since 1850 *imports of sugar into India slowly and steadily increased.*—The home production was not sufficient for the growing population, and the comparatively high price of Indian sugar and the low price of foreign sugar altered the conditions of trade. Until 1890-91 the bulk of sugar came from Mauritius, whose Government approached the Government of India to take action. The Government of India imposed, in addition to the general rate of 5 per cent import duty, a countervailing duty equivalent to the bounties granted to the export of beet-sugar. A considerable reduction in the import of Austrian and German sugars followed. The countervailing duties imposed on imports did not cover the whole of the country. In order to protect the cane-sugar of Mauritius, the duties were increased in 1903 in accordance with the findings of the international convention relative to the bounties on sugar. As a result, beet-sugar was insignificant in 1912.

These restrictive measures did not diminish the volume of Indian sugar imports, nor did they help to develop the Indian sugar industry directly. The demand for white sugar has increased owing to the increased consumption of tea, coffee, sweet beverages, and aerated waters, and exceeds the domestic supply, with the result that the greater portion of the share lost by beet went to cane. Bulk of imports came from Java. *The superiority of the beet industry of Europe or the cane industry of Java lies in effective organization and the application of scientific methods of production.*

The iron crushers, the use of centrifugal machines in the Khandsari (Desi) process of sugar manufacture, the central factor-

*Published by kind permission of Professor C. D. Thompson, Department of Economics, University of Allahabad.

ies, and the increased cultivation of improved varieties of cane have singularly changed the outlook of the Indian sugar industry because of the improved variety of cane; the yield, on an average, of sugar-cane has increased by 50 per cent, and within the last 10 years we have progress in the sugar content of cane from 6·85 to 9·07 per cent, whereas in Java it is 9·75 per cent. The area under improved cane is continually increasing. As much as a quarter of the total acreage of cane production is under improved cane. Thus the Coimbatore cane-breeding station has produced seedling canes of high merit both in regard to tonnage and high quality. The agricultural side of the problem is practically solved, though continuous effort is necessary. In some portions of the sugar-cane belt cane of good quality can be produced as cheaply as in any other country in the world. There is no reason why India should not be self-supporting in her sugar-cane products once the industry is properly organized and helped through agricultural research work and by a protective duty. India still has the largest cane area in the world, and she is nearly the largest consumer of sugar. If any industry can claim its stay, it is sugar.

A Sugar Committee was appointed by the Government of India in 1920 to report on the possibility of organizing and developing the sugar industry in India. Owing to conditions then existing, it was supposed that India could not supply her own wants in the face of low yields both of cane and raw sugar and the percentage of available sugar extracted from cane. As mentioned above, the improved varieties of cane from Coimbatore have shown a marvellous recovery in the yield of cane per acre and in the percentage yield of sugar from cane; consequently the Government of India asked the Tariff Board to report in 1930 on the desirability of granting protection to the sugar industry. The Tariff Board, after having fully satisfied itself, recommended to Government in 1931 that the industry does make out a case for protection, and laid out a scheme of method and amount of protection. *The Government of India thereupon accepted the duty proposed by the Tariff Board, which is Rs.* 7-4 *per cwt. for a period of* 7 *years, afterwards to come down to Rs.* 6-4, *and to remain at that figure for the next* 7 *years of the period recommended for protection and levied it accordingly.* Due to trade depression, the budget receipts of Government fell short of expectations, and a surcharge of 25 per cent on all existing rates was levied in September, 1932. Thus we find that the sugar industry is enjoying a protective duty of Rs. 9-1 per cwt. As a result, 12 new central factories have been added in 1932, and the number has now reached 56. Several more are contemplated. With the present protection and improvement in cane and organization, it can be said with surety that the 10 lakhs of tons of white sugar which India imports would be

replaced by Indian sugar within a period of 15 years. Thus the Indian industry may regain its former position, at least in the matter of supplying her home demands. In the meanwhile, it is hoped that Government will help the industry to accelerate its onward progress through its Imperial research stations and provincial farms.

Conditions to Secure Protection in General.—

It is enough to lay down here that the policy of protection involves sacrifices; and an all-around, all-inclusive protective system can never be advantageous. "Protection ought to be afforded only to such industries as have a reasonable chance of successful development," justifying sacrifice of present advantages to secure future advantages of greater and substantial importance to the well-being of the country. The problem of protection has been completely thrashed out by the Fiscal Commission, which recommends 'the Discriminate Protection Principle—meaning thereby protection to the industry which, if protected, has a chance of successful development, justifying thereby the sacrifices incurred for it by the nation.

We can do no better than quote the general conditions to be satisfied by industries before protection can be granted to them as laid down by the Fiscal Commission itself:

"1. The industry must be one possessing natural advantages, such as an abundant supply of raw material, cheap power, a sufficient supply of labour, and a large home market.

"Such advantages will be of different relative importance in different industries, but they should all be weighed, and their relative importance assessed. The successful industries of the world possess certain comparative advantages. No industry which does not possess some comparative advantage will be able to compete on equal terms. Thus it must be ensured that no industry is protected which shall become a permanent burden on the community.

"2. The industry must be one which without the help of protection either is not likely to develop at all, or is not likely to develop so rapidly as is desirable in the interest of the country.

"The main object of protection is either to develop industries which otherwise would not be developed, or to develop them with great rapidity."

The following are the arguments for the protection of the sugar industry under the conditions given above. As a result, it is found that the sugar industry passes the test, admirably and forcefully claims protection at the hands of the State.

"3. The industry must be one which will eventually be able to face world competition without protection."

Of course, under discriminate protection, the protection contemplated is temporary as one of the essential conditions of discrimination.

Industries of national importance are exempted from passing the test of the above three conditions which they need not satisfy. Other conditions which should also be satisfied are that the industry does not affect adversely consumers and other industries dependent on it.

The Case Made out for Protection to the Sugar Industry

(a) *The World Position.*—The present depression in the sugar industry throughout the world has been brought about by an excess of production over consumption. New land was brought under sugar-cane in Cuba due to shortage of beet-sugar. The subsequent revival of beet, the phenomenal success of sugar-cane breeding experiments in Java, the idea of national safety recognized after the great war the, huge production in Russia, the refusal of Japan to buy foreign sugar, producing sugar for itself in Formosa, and Great Britain's following suit have all led to increased production. The following figures will show that consumption has not increased, at the same rate as production:—

TOTAL WORLD PRODUCTION AND CONSUMPTION OF SUGAR

Years		*Production, Tons*	*Consumption, Tons*
1927-28	...	26,675,000	26,373,000
1928-29	...	28,880,000	27,479,000
1929-30	...	28,460,000	26,988,000
1930-31	...	29,717,000	26,988,000

The prolonged period of depression and increased output have kept the prices very low, sometimes beyond the level of profit. Tariff arrangements of beet-producing countries have accentuated depression. Following the lead, cane-sugar countries also armed themselves with tariff walls and duties, with the result that, both in producing and consuming countries, sugar is subject to heavy duties, either in the form of direct protective duties, or by bounties, or by preferential duties.

(b) *The Indian Sugar Industry As It Stands.*—The total

output of white sugar has been increasing in India as is clear from the following table:—

	Tons
In 1919-20 white sugar manufacture amounted to	13,613
„ 1926-27 „ „ „ „	29,707
„ 1929-30 „ „ „ „	89,000

The above figures are indicative of real advance on the Indian side. This is due to the fact that the improved variety of sugar-cane from the Imperial Research Station, Coimbatore, is being increasingly cultivated practically all over India, especially in Northern India, covering more than three-quarters of the cane cultivation area in India. The cane in India contains now, on an average, 9·07 per cent of sugar as a result of improved varieties, whereas in Java it has 9·75 per cent. The increase has been from 6·85 to 9·07 per cent. The factories are alive to the improved cane cultivation. In 1927-28 there were 25 sugar factories; in 1928-29 the number rose to 44; and by the end of the year 1932 there were in all 56 factories; several more are being erected, and several are in contemplation. The standard of efficiency attained in the extraction of sugar from cane is barely 5 per cent less than the average in Java. In the matter of manufacture, the factories are close up to Java, as given by Mr. Shakespeare, managing director of the sugar firm of Messrs. Begg, Sutherland & Co. before the Fiscal Commission as for back as 1921. *It is mostly the agricultural side that requires protection from Government,* whose duty it is to find out improved varieties and methods of cane cultivation, and to provide cane which ripens earlier, and thus help in the increase of the working season, through its own research institutes and farm experiments, namely, the Imperial Research Station, Coimbatore, and such Government provincial farms as those at Shahjahanpur in the United Provinces, Pusa in Bihar, Gurdaspur in the Punjab, Jorhat in Assam, Samalkota in Madras, Manjari in the Bombay Presidency, and Tharsa in the Central Provinces.

The Cost of Sugar cane is Two-thirds of the Cost of Sugar.— The future of the sugar industry, as gathered from the above, depends mainly on the cost of producing the primary material cane. The protection desired is for the period during which the agriculturist could increase his yield in quality and quantity per acre with the help of improved cane from research stations, and with the improvement of the method of cultivation, thereby decreasing effectively the cost of cane, while maintaining or increasing his own profits.

The interest of agriculture is threatened (1) by the large

imports of foreign sugar; and (2) by the large increase which is expected due to the improved variety of cane.

IMPORTATION OF WHITE SUGAR

Years			*Imports, in Tons*
1908-09 to 1910-11	...	...	5,62,000
1911-12 to 1913-14	...	...	6,25,000
1917-18 to 1919-20	...	...	4,11,000
1923-24 to 1925-26	...	...	5,82,000
1926-27 to 1928-29	...	...	7,33,000
1929-30	...	...	10,00,000

It would be very unfortunate if the factories were to succumb to foreign competition, or on account of failure to market the increased output from the improved canes, and thus the receipts of the agriculturists were to fall and the area under cane to diminish, since 13 to 15 million people subsist on cane production. The industry is thus of national importance from its agricultural point of view, and of wider and far-reaching effects than its economic aspect.

The cultivation of cane depends for its importance on the products manufactured from cane. *The refining of gur (raw sugar) is not an economic form of sugar production when compared with the direct manufacture of sugar from cane-juice.* One hundred maunds of cane in India give 10 per cent of gur, out of which not more than 55 per cent of sugar is obtained. The product from 100 maunds of cane converted into gur and then refined is not more than $5\frac{1}{2}$ maunds against 9 maunds obtained direct from the cane-juice, while the amount of molasses produced is exactly the same in both cases. This production is thus wasteful to country resources. The variation in price between gur and imported sugar is not proportionate. The gur has its own demand, irrespective of the fluctuations in the trade of sugar. Gur in India is consumed as gur; it has its own position unaffected as an edible directly consumed; and, due to religious and national sentiments, most of the people prefer it even though they have to pay more in comparison to imported white sugar. In times of depression it may be profitable to refine gur. It might be possible to establish refining factories on the basis of import of unrefined sugar from abroad by lowering the duty. **The interests of the refiner and of the gur manufacturer, who is also the cultivator, are opposed.** If Indian gur is used, the third condition of the Fiscal Commission purporting that the industry would be eventually able to face world competition is not fulfilled. If foreign low-grade sugar is used, the first condition of the same commission regarding the abundant supply of raw material is not satisfied. Hence no case exists for the refining industry as such.

The production of sugar directly from the cane-juice does seem to come up to expectations, and it also needs undergoing the three conditions of the Fiscal Commission before it can claim protection.

(c) *The Conditions Justifying Protection to the Manufacture of White Sugar Considered.*—The first condition of the Fiscal Commission lays down that the industry must be one possessing natural advantages, such as an abundant supply of raw material, cheap power, a sufficient supply of labour, and a large home market.

Supplies of Cane.—The total area under cane has remained between 20 to 30 lakhs of acres; the outturn of cane per acre varies from 30 to 10 tons per acre, the former in Madras and Bengal, the latter in the Punjab and Bihar and Orissa, and somewhere about 13 to 15 tons per acre is the output of the United Provinces. For the manufacture of sugar directly from cane requires not only a sufficient quantity of cane, but the cane should be fresh since the sugar contents begin to deteriorate rapidly after the stalks have been cut. It is desired that the cane be delivered to the factory within 24 hours. In India, where transport is through bullock-carts, a distance of 16 miles all round the factory constitutes the limit within which the supply of cane is possible; or, in other words, an area of 5,14,720 acres of cultivated cane are available to a factory. Under Indian conditions a factory crushing 48,000 tons of cane or 13 lakhs of maunds producing between 4,000 and 5,000 tons of sugar per year, is taken as an economic unit costing Rs. 13,53,068.

Let the minimum yield in tons per acre be 10 tons in Northern India, 15 tons in Bengal, and 20 tons in Madras and Bombay, where intensive cultivation is carried on.

CONCENTRATION OF CULTIVATION OF CANE IN THE PROVINCES

1 Province	2 Percentage of cane area to total area under cultivation in 1928-29	3 Minimum outturn, in tons per acre	4 Acres required to supply a factory	5 Acres from which supplies may be drawn 16 miles round	6 Percentage of 3 on 4
Madras ..	0·23	20	2.400	5,14,720	0·46
Bombay ..	0·19				
Bengal ..	0·68	15	3,200	5,14,720	0·62
Bihar & Orissa	0·95				
United Provinces	3·12	10	4,800	5,14,720	0·94
Punjab ..	1·25				

Considering the table, and comparing column 6 with column 2, we find good reason to suppose that the can areas are sufficiently concentrated to admit white sugar manufacture in Bihar and Orissa, the United Provinces, and the Punjab, and possibly in Bengal, but not in Bombay and Madras, save in favoured localities. Yet there are difficulties in these areas of an economic working. In the Punjab, for climatic reasons, cane can have too short a period after ripening. In the United Provinces and Bihar and Orissa the working season can be extended to 120 days, but in certain localities gur of excellent quality commands a high price, and difficulty may be felt in obtaining cane for factories. Another difficulty is that as the main sugar-cane belt lies in the sub-tropical region, the climate and rainfall affect the growth and yield of sugar-cane adversely as compared with the tropics. Another difficulty is that of the small scattered holdings standing in the way of improved tilling, and organized supply of cane to central factories. In spite of these difficulties, continued progress in the introduction of superior varieties of cane, and improvement in the process of manufacture, the existing areas will be able to yield at a reasonable cost a large proportion of the amount of sugar at present imported, while maintaining or extending the supply of gur.

Cheap Power.—In the manufacture of sugar the whole of the fuel required for generating power is provided by the bagasses; thus this question is not material.

Sufficient Supply of Labour.—The majority of the factories and established in rural areas to obtain the sugar-cane fresh from the fields; otherwise, the sucrose contents are lessened with the lapse of time, and draw their labour supplies from the villages surrounding the factories. Sugar manufacture comes at a time when the Kharif crop is reaped and the Rabi is harvested. Thus agricultural employment is small, and little difficulty is felt in securing cheap labour.

WAGES COMPARED WITH OTHER SUGAR-MANUFACTURING COUNTRIES

	Per Diem s.	Per Diem d.
India	0	9
Java	0	10
Philippines	1	6
Natal	2	8
Mauritius	3	6
Cuba	5	0
Hawaii	6	0
Queensland	17	0

Large Home Market.—India imports at present 10 lakhs tons of white sugar.

About 1 lakh tons are manufactured by factories in India, 2 to 2½ lakh tons are manufactured by the Khandsari, or Bel, process in Rohilkhand, and about 20½ lakhs tons gur are consumed every year. The consumption of raw sugar and sugar may be valued at Rs. 60 crores annually. Java, Cuba, Mauritius, and the West Indies—the most important cane-sugar-producing countries—have no home market. The consumption in all these amounts to 630,000 tons as against a production of 88 lakhs tons. It is obviously clear that, in this respect as well, India has an undisputed advantage.

The second condition of the Fiscal Commission lays down that "the industry must be one which, without the help of protection, either is not likely to develop at all, or is not likely to develop so rapidly as is desirable in the interests of the country." The sugar industry till 1926 had a high revenue duty of 25 per cent plus Re. 1-8 per cwt. But, so long as duty remains a fiscal measure, its continuance from year to year rests entirely on the revenue requirements of Government.

Condition of Gur Industry without Protection.

Let us start with the assumption that the 15 per cent is the general rate of import duty.

(*a*) In 1929-30 Java gur was sold in India at Rs. 5 per maund. The average price of gur in Madras at that time was Rs. 8-4 per maund, allowing for a rate of duty at 25 per cent *ad valorem* in 1929-30; imported gur was a serious danger to the indigenous industry, at any rate in the port towns;

(*b*) The average rate for palmyra jaggery was Rs. 4 per maund, being approximately the price which Java gur could be landed ex-duty; without revenue duty it would have been almost killed.

The fear of Java gur is not great as not mere than 20,000 tons of gur are manufactured by farmers, and factories have no hand in it; but, if the latter take it up, the industry would be ruined if no protective duty is levied;

(*c*) **Artificial gur** is made in Calcutta by mixing Java white sugar, at Rs. 3-15-1 per maund, and molasses, at Rs. 2-5 per maund, ex-duty, in the ratio of 1:3. Thus a gur at Rs. 4 per maund can be easily put on the market. Even with a duty of Rs. 6 per cwt., the imitation gur could replace indigenous one if the flavour, which is a premium commanded by desi, is obtained. And even conservative people would not be able to resist the economic pressure, and would like to buy cheap gur.

Condition of Indigenous Sugar without Protection

The United Provinces Government informed the Tariff Board that, for the cultivator to obtain a satisfactory return for his cane, the price of sugar must stand between Rs. 11 and Rs. 12, otherwise the Khandsari process would cease working. Java sugar can be sold at Calcutta for Rs. 3-15-1, without duty. The railway freight, terminals, wages, and interest amount to about Re. 1-9; and, allowing for a 15 per cent duty, the price per maund of sugar (imported) would be Rs. 6-1-7. This price will not permit the agriculturist to be paid even for his cane, resulting in serious consequences to agriculture in the northern tract.

Condition of Factory Sugar without Protection

Many of the factories pay Rs. 5 per maund of sugar for the cane. With Java selling on their head at Rs. 6-1-7, as calculated above, factory sugar would have no chances of production, and the removal of duty will be followed by an agricultural breakdown.

The third condition of theFiscal Commission says that "that industry (seeking protection) must be one which will eventually face world competition."

It is desirable to repeat what has already been said before: That State assistance by means of subsidies and tariffs is still carried on by countries to protect sugar.

Comparative Cost of Production Per Cwt of Chief Sugar-producing Countries of the World, and Their Respective Quota Production.

Countries	*Production, in tons, of sugar*	*Cost of production per cwt.*
		s. *d.*
Cuba	45,50,000	8 4½
Java	30,00,000	9 3
Fiji	90,000	12 3
British West Indies	2,50,000	12 4½
Hawaii	7,87,000	13 6½
South Africa	2,70,000	15 8½
Germany	19,61,000	15 11⅓
Formosa	8,30,000	17 7
U.S.A. (Beet)	10,10,000	18 8
Australia	5,17,000	23 0
Argentina	3,75,000	24 0
India	3,00,000 (Nearly)	17 0 to 15·9 or Rs. 11-5-4 to Rs. 10-8

The above table strengthens the case for the protection of sugar in two ways—

(1) With the improved variety of cane under which quantitative and qualitative increase has been attained, as given earlier, the progressive and increasing cultivation of it will give a reduced cost (13s. 8d. per cwt., as calculated by the Tariff Board). Thus India ultimately will be able to manufacture sugar at a cost not higher than two-thirds of the world's supply; and

(2) The total production of beet-sugar may be placed between 9 and 10 million tons out of a total of 27 million tons of world production. It is impossible that such a large quantity as this, mostly helped by subsidies and tariffs, can be replaced by cane sugar-save at a very greatly enhanced cost. The Indian cost is considerably below the beet-sugar cost. If even the subsidies and tariffs were to be removed, the the consequent reduction in the total supply of the available sugar, would raise world prices, in spite of the low cost of Java and Cuba.

From the table of costs it is clear that Indian cost is equal to Hawaii, and less than any, except Java and Cuba, in spite of climatic disadvantages, as given earlier.

This is enough to validate the cause of sugar manufacture in India to be protected in all its branches, with the exception of the gur-refining process.

The Condition of National Importance Satisfied

Cane Cultivation Has a Place in Rotation of Crops.—The strongest case for protection which need not satisfy other economic conditions is that of the industry which is of national importance. The sugar industry has a very important place in the agricultural development of the country. It has a recognized place in the rotation of crops. The yield of crops grown after sugar-cane is generally higher due to the residual manure and the deeper cultivation required for cane. The well-irrigation problem, as a condition precedent to this intensive cultivation, presents serious difficulties if no cane is grown in the heavy populated tracts; thus its cultivation is essential to agricultural development.

Its Importance to Government.—Due to world conditions, prices of the staple products of agriculture have gone down. The case of sugar-cane is opposite. The imports in India of white sugar amount to 10 lakh tons. There is thus a market for increased production of sugar-cane, provided it is available for the manufacture of white sugar. The farmer has thus a chance to make cane his cash crop; he will have enough to give away for his rents and irrigation dues. The fields used for other crops after

the cane crop will fetch higher rents due to their high productivity. A serious fall in the area of cane will thus affect the return for irrigation works and their prospective development, and that of the economic development of the country, which is almost agricultural as a whole.

Source of Cattle Fodder.—Every acre under cane supplies half a ton of cattle food.

Affords Employment to Labourers and Their Cattle.—The workers' remuneration consists of the right to appropriate the upper top leaves. The crop affords work to the workers and labour and their cattle during the vacant interval between the Kharif and Rabi crops. The Imperial Council of Agricultural Research has said that an acre on an average is worked by a family of four to five members. Thus the labour employed for weeding, harvesting, and the allied manufacture of gur is 15 millions.

Other Grounds of Protection to White Sugar.—As given above, the factories established in rural areas will give employment to people in the slack reason, and the replacement of a million tons of sugar will result in the retention of Rs. 12 crores, which will allay the industrial depression, prevalent in India as elsewhere, a great deal, and afford assistance to agriculture.

Gur Industry: Its Immediate Protection Essential.—Of the total cane grown in India, taking the minimum output of 10 tons per acre, maybe amounting to 25 to 30 million tons, 72 per cent is utilized for the manufacture of gur. Any increase in the preparation of imitation gur from imported sugar and molasses will decrease the acreage under cane. Therefore the first step would be to protect indigenous gur to the extent that the manufacture of imitation gur is rendered definitely unprofitable. The increase in the output of cane would be 50 per cent, or near about 6·2 million tons, in the United Provinces and Bihar and Orissa. Under the improved variety indications of falling prices are already there of gur; in 1932 it went as low as Rs. 2 to Rs. 3 per maund. The remedies out of this glut of gur are: (1) To find markets in Southern India, where the cost of production is great when compared with the north; and (2) the preservation of gur in specially-constructed vessels against climatic effects to be used for refineries. Steps must be taken in the form of protection. White-sugar manufacture is essential for the outlet of the surplus of cane. The cost of cultivation is too high for Bombay and Madras. The sucrose content of cane being greater in Bengal due to tropical cultivation, and also as a result of lesser cost, sugar factories may be established there. Over 2 million acres are still under Desi cane. An increase of 10 tons on an acre due to improved cane cultivation would be sufficient for 900,000 tons

of white-sugar manufacture. Hence the import duty must ensure tho continuance and rapid establishment of new factories.

Khandsari process of sugar manufacture must remain in the country where the means of transport are poor. The progressive use of centrifugals has increased the percentage product from 4 to 5·25 per cent per 100 maunds of cane. It can stand the selling rate of sugar ranging from Rs. 11 to Rs. 12 per maund. With the development of the sugar industry increasing acreage will be put under cane at one compact place near factories. It will be possible then to replace the Khandsari process by central factories, but not till then. In the transitional stage they are a necessity.

Protection hence is the crying need of the sugar industry. Protection by bounty will not be successful, being intermittent in nature, and thus entailing administrative difficulties. Duty for protection seems to be the only way; it is required to be levied on all classes of sugar, and no consideration should be given to the case of the refining industry, which needs low-grade foreign sugar, as mentioned earlier, on two grounds, namely, agriculturist and sentimental.

The consumer effect of protection on Indian gur would be nothing. Up till now very little gur has been imported. Indian gur has its local demand and supply. Protection will protect the religious and sentimental susceptibilites of people using desi against the sale of cheap imitation gur.

Effect of Protective Duty on Sugar-consuming Class.—In the improvement of cane cultivation and method a reduction in cost will be effected, and eventually the consumer will obtain it at a lower price. The incidence of protection will be higher in the case of the rich and middle classes, who are best able to bear it; and then it is they who are mainly going to reap the profits of protection.

Effect of Protection on Industries Using Sugar.—Molasses from which denatured spirit is prepared would be obtained at lower prices if more factories were established. In 1931 the price of molasses rose, and then the methylated spirit manufactured in India could not compete with the foreign spirit. The duty has been left unaltered. Thus distilling and tobacco-curing are left unaffected.

The largest industry using sugar is the confectionery which is using imported sugar. Indian sweetmeats are not in competition with the imported, so this industry also will not be affected. European confectionery already carries a high duty of 50 per cent *ad valorem*, and an additional protective duty is not likely to affect this industry either.

Conclusion.—In conclusion, we find that the case for the protection needed for the sugar industry has admirably passed all the tests and conditions laid down for the protection of any industry. The advantages are of first-rate national importance. The industry is mainly dependent on the agricultural aspect of cane cultivation. It has been noted that cane cultivation plays a very important role in the rotation of crops and in the agricultural development of the country. The people dependent on the industry are calculated at 15 millions; with a happy peasantry, a higher standard of living is sure to be reached. An increased consumption of sugar is fast developing with the change in taste. It is not difficult to think that India might regain her lost position in the export market after satisfying her wants, though it will take a very long time. There is a vast field for the utilization of by-products, namely, molasses and bagasse. The last named might be used in the manufacture of paper, but, so far, it has met with little success. Molasses could be used with advantage as fodder and manure and for the manufacture of spirit. So far, little has been done on a large scale in the field of the manufacture of spirit. Incessant research might bring in view a method which will enable the production of spirit out of molasses at a cost equal to the foreign product, if not cheaper. There is no need to stress the self-evident fact that the industry is a national industry. It is consoling to think that the Government of India, on the recommendation of the Tariff Board, has so promptly afforded protection to the industry. As a result, compact areas are being brought under cultivation. Twelve new factories were opened last year, and the opening of many more will follow. This is all very auspicious for the agricultural and industrial life of the country. *Increased sums should be allotted by Government for research work in all spheres of the industry since without such measures the protective scheme will be delayed, if not defeated, in its object.*

(Continued from page 289)

difficulties at the outset, but that is no reason why they should not be overcome when we are all equally interested in the matter. The problem is, no doubt, one of great magnitude and complexity, but on its solution depends the happiness and prosperity of the vast masses of this country. NOTHING IS DIFFICULT BEFORE THE RESOLVE AND SPIRIT OF SERVICE.

"Adequate progress cannot be expected until separate financial provision is made, in central and provincial budgets for Animal Husbandry work of all kinds, quite apart from that made for the development of arable agriculture."

HINTS ON VILLAGE UPLIFT

By Jyoti Prasad, Divisional Superintendent of Agriculture, Allahabad Division

Every villager prays for his all-round prosperity. Why does he not get it?

Because—

1. He is very conservative of ideas, and, being illiterate, is ignorant of what progress village folk of other civilized countries and in other parts of his own country are making, and what he can himself make, *if he sets his mind to it.*

2. He pays no attention to his home and to his village, and spends no time or thought over bettering himself and his surroundings.

3. He cares little for the general sanitary conditions of his village, which are filthy and dirty.

4. He wastes all his wealth on ill customs and unnecessary litigation.

5. He neglects the education of his children.

6. He understands very little about the principles of co-operation.

Consequently—

1. His methods of farming are very poor, with the result that his financial condition mostly remains unsatisfactory.

2. His family is a prey to epidemic disease.

3. He is not economical in his habits, and becomes indebted soon.

4. His children do not prove to be of much help to him for want of proper education.

Remedies—

A—Agriculture

1. *Preserve Cattle-dung and Urine for Manure.*—We waste both. Cattle-dung is either left in the open, or is used as dung-cakes for fuel purposes, while urine is allowed to waste. When washed down by the rains, it flows in the neighbouring low places, where it creates insanitary conditions in the villages. If both are preserved carefully, they will give us not only a good quantity of manure, but they will produce very effective stuff. The pitting of cattle-dung is recommended under a thatching, while urine can be preserved by catching it in a layer of earth or litter. The earth that is saturated for a few days should be removed to the field as manure, and the litter, perfectly soaked, should be thrown into pits

along with the dung and allowed to rot. The practice of converting cattle-dung into cakes does not prove to be advantageous, while the utility of it as a manure is more important.

2. *Prepare Composting.*—A new method for converting waste green matter into useful manure. The green refuse matter, when mixed with the dung and urine available with a cultivator, gives a larger quantity of manure. (Detailed process of manufacture can be had from agricultural officers.)

3. *Follow Your Land in Hot Weather.*—This improves fertility if the land is ploughed deeply and left open.

4. *Follow Suitable Rotations.*—Richness of soil is improved with less expenditure on manure, keeps labour and cattle occupied, and provides money to the cultivator throughout the year, and minimizes chances of loss. If one crop fails, the other gives a good return.

5. *Introduce Green Manuring.*—Very useful to improve textureof both sandy and clayey soils. Increases power of retaining moisture in the soil.

6. *Preserve Your Seed.*—The seed, when not damaged by weevils, should be used for sowing purposes.

7. *Use Improved Seeds.*—Good seeds always produce first-class crops, yielding better, both in quantity and quantity. Purity should be the main consideration.

8. *Select Paying Crops.*—Selection of certain crops, such as sugar-cane, potato, cotton in place of Bajra, kodon, etc., gives more money to a cultivator.

9. *Try Improved Methods of Cultivation.*—Sowing in lines is very economical in the long run, and improves the quality of the produce.

10. *Keep CropsFree from Disease.*—In this respect, precaution, as advised by an agricultural expert, does much good, and saves a cultivator from great loss.

11. *Use Meston Plough and Other Modern Implements.*—A mere scratching of land with a country plough is nothing but a waste of energy, while the inverting of soil with a deep ploughing improves the fertility of the land by exposure, and consequently gives better results. Similarly, other implements save a lot of time, and labour, and money. This makes cultivation less expensive.

12. *Keep Good Cattle.*—Bad cattle eat as much as good ones but give a far smaller return to their owner. A strong pair will work as much as will four or five of poor quality. First-class cattle do not only yield more milk ghee, but also produce much better calves. In order to improve our cattle, we should take advantage of the Govern-

ment scheme of stud-bull distribution free of all cost. They are distributed in villages by the Agriculture Department according to the suitability of the locallity. Information as to the terms of supply of these can be ascertained on application to the Deputy Director of the circle in which the applicant resides.

13. *Learn Good Management.*—Good management is always paying, but for a cultivator in particular it is most beneficial. To arrange all his requirements in time not only reduces the expenses of cultivation, but also gives better crops.

14. *Organize Small Agricultural Shows and Demonstrations.*—These, when arranged on the occasion of local fairs, as at central places in rural areas, give an opportunity to visitors to see the agricultural improvements of their locality, create an interest in, and encourage, them, and also convince them of the various advantages of improved agriculture.

15. *Consolidate Your Holdings or Grow Crops Block-wise.*—Cultivation on scattered areas requires more time, money, and labour.

16. *Follow Intensive Cultivation.*—It is more paying, and is more easily manageable, than extensive farming.

17. *Improve Fruit Culture.*—During these crises, when there is economic depression on account of the unsatisfactory general agricultural outlook, fruit fetches more money as this is an untapped source of wealth.

18. *Plant Trees on Vacant Land.*—This gives plenty of wood for cultivation work, as well as for fuel, which replaces dung-cakes; thus a large amount of cattle-dung becomes available for manuring purposes.

19. *Have Good Relations with Neighbours.*—They are always sympathetic and sincere when any emergency for help occurs.

20. *Have Self-supervision*—the only key to success in agriculture. No cheating, no stealing, and no waste of labour.

21. *Increase Supply of Water in Your Wells by Boring*—In case where a canal fails for want of an adequate supply, well irrigation saves your crops. Boring is a new method of increasing the supply of water in wells; rather it ensures it. Apply to your District Collector for it when necessary.

B—Sanitation

1. *Throw All Your Sweepings and Rubbish outside the Village.*—This will minimize the chances of the multiplication of flies and and germs,and of keeping you free from obnoxious smells.

2. *Construct Your Cottages Well Ventilated and Airy, and Keep Them Neat and Tidy.*—A free access of fresh air and light is

always very healthy, while in dark houses the occupants are liable to catch disease.

3. *Use Clear Drinking Water.*—No collection of filthy water should be allowed to accumulate in pools close to your wells. Have your bath daily, but not on the jagat of wells. The use of unclean pots and ropes for drawing water from wells is not advised.

4. *Wash Your Clothes When Dirty.*—This is not sometimes so expensive as it becomes when any illness results as a result of wearing dirty clothes.

5. *Keep Your Kitchen and Also Your Cooking Utensils Clean.*—This keeps your food materials free from any infection, and saves you from catching any disease.

6. *Take Exercise Daily.*—This makes your muscles strong and sound, develops your body, and makes you healthy.

7. *Don't Allow Any Tank or Pool Near Your Habitation.*—This serves as a centre for breeding mosquitoes, which bring about malaria and affect the health of village people.

C—Education.

It is only education which develops the mind of man and gives general information all round. As far as the masses of the agricultural population are concerned, the removal of illiteracy is the main consideration. Therefore the objects in view should be—

1. *Introduction of Compulsory Primary Education in Rural Areas.*—The only means by which may be overcome the unwillingness of parents to send their children to school, and to keep them there till literacy is attained. Also be particular about your female education.

2. *Secondary Education.*—Elementary agriculture, as an optional subject in the curriculum of the vernacular middle schools of the rural areas, will certainly give agricultural training to the sons of agriculturists. Under this system the instruction to be given in the class-room should be not only theoretical, but also practical, in all agricultural processes conducted on a small farm attached to the school.

3. *Technical Education for Cottage Industries, such as Basket-making, Rope-making, Weaving, etc.*—This, when attained, will keep you and your family occupied in various ways, with the result that your financial condition will improve.

4. *Higher Education.*—This is provided at agricultural colleges established almost in every province. *In general, the object, of these institutions should be not to train students for Government service only, but to train them to manage their own land and that of others.* They can do a lot for agricultural research work.

5. *Adult Education.*—By reading books and newspapers to uneducated and grown-up persons of the villages in the evening, when they are free from their respective work, general information is obtained which enables them to improve their agriculture and their condition in general.

6. *Membership of Village Panchayat Is Also Educative.*—By associating with the workers in connection with the village uplift movement, as well as that carried on by the Publicity Department, for the well-being and advancement of rural areas, good scope offers for the exercise of a wide range of talent and inclination. Such service is of the utmost value to the State, and also to the country, as the welfare and happiness of the peasants is largely dependent on the merits and efficiency with which the local services are administered.

D - Co-operation

Co-operation is an essential means by which progress in general, and agriculture in particular, can be easily facilitated in rural areas on a stable footing. It should therefore be the main function of the Co-operative Department, apart from the provision of credit, to prepare the ground for the advice of the various experts employed by Government in the various departments. Naturally, these departments can work best through co-operatively-organized bodies of cultivators rather than through an isolated individual.

In these days, financial conditions being very unsatisfactory, there is really a great obstacle in the way of our rapid improvement. However, the credit societies organized by the Co-operative Department at various places have solved the difficulty to a great extent by removing the evils of indebtedness in the villages; but, from the agricultural point of view, co-operation can be extended to other activities, e.g., seed supply, implement supply, manure supply, cattle supply, and better-farming and sale societies. These activities, when carried on in consolidated areas with the help of the other departments concerned with rural welfare will surely crown our scheme with success.

It is indeed a happy idea that a golden opportunity is being given for convincing the illiterate masses of the advantages of rural uplift by the Publicity Department having arranged demonstration-vans throughout the provinces, thus organizing an agricultural industrial show in every district to educate the people; besides, attempts are being made to revive incorporate village committees. Old songs, village dramas, and wrestling bouts also help to attract the people to see how general progress can be made for the betterment of the country. Doubtless there are

(Continued on page 284)

SOAP INDUSTRY

By A. P. Mathur, M.A.

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Meerut is the only important centre of soap-making in the Grid Area*. It has been manufacturing high-quality soaps since the nineties of the last century. Before 1914 there was the North-west Soap Company, the biggest soap-manufacturing concern in the United Provinces, which manufactured soaps of all varieties on a large scale. But, after it wound up its business, a number of small shops sprang up which started making Pavitra soap by the "cold process." Since then, Meerut has become popular for its Pavitra soap, or soaps free from animal fat. At present there are 15 soap factories, giving employment to about seventy workmen. Each factory is run by the proprietor himself, with the assistance of three or four men. The proprietor generally supervises work and does selling, and the workers do the actual operations. The processes of manufacture are quite simple, and there is no specialization. The factories are mostly located in the main bazaar. The front portions of these factories are meant as shops, and the back ones carry on the manufacturing processes. A peculiar feature about these shops is that nearly all of them bear the name of "Munna Lal," with the distinction of surnames only; e.g., some designate themselves Munna Lal Goyal, some Munna Lal Sharma, Munna Lal Bhargava, etc. The name Munna Lal has an interesting history behind it. Munna Lal was the name of an employee in the North-west Soap Company. He started his own business of manufacturing Pavitra soaps by the "cold process." During his lifetime he earned a very high reputation for his soaps, which commanded huge sales. After his death a number of manufacturers, in order to secure an advantage by the use of his goodwill, styled their shops after his name.

Process of Manufacture.—There are two methods of manufacturing soaps—one known as the "cold process," and the other the "boiling process." The latter is more elaborate than the former, and requires external heat, which is essential in the boiling process. The former, as its name implies, is carried on without employing heat, except for melting the oil. The "cold process" is quite simple, and does not require skilled labour to work it. It is the only method fit for cottage workers. Meerut soaps are now made entirely by this process. Some years ago a small amount of glycerine soap was also made by the hot process, but this has now been abandoned.

*The Grid Area comprises eight districts of the Northern United Provinces.

The following is the working process

First, the oil is melted, then a certain amount of china clay, generally in the proportion of a quarter of a seer to a maund of oil, is mixed. After this is added very gradually a correctly-weighed quantity of caustic soda solution, the whole mass being continually stirred with a small wooden rod. Colour and perfumes are added during the stirring process. The stirring is continued till all the lyes are in and until the mixture thickens to the consistency of treacle. This condition would be attained generally in the course of a quarter of an hour, depending upon the temperature of the oil and the external temperature. When the mixture of oil and caustic solution thickens, it is placed into frames or plates, as they are called, made of wrought-iron, where saponification proceeds vigorously. Saponification is generally complete within twenty-four hours. When the soap is cold, the sides of the frames are removed by unscrewing the nuts, when a hard block of soap will be exposed to view.

For cutting blocks of soap into slabs of the required thickness a mark or gauge is made on the four sides of the block by means of a pointed stick, and straight lines are drawn joining the four points through which, by pulling a thin steel wire, the slabs can be neatly separated. These are cut into bars of suitable size again by the steel wire. The bars are then reduced to cakes by a similar arrangement. The cakes finally come to the stamper, who stamps the name of the soap and its maker. The soaps are rubbed smooth, and, wrapped in paper, are then packed into boxes.

Process of Making Washing Soap.—Dhobi soap, or washing soap, is made by a semi-hot process, which is as follows: Oil is poured into big iron pans and melted. Three-fourths of caustic lye are then added. It is stirred, and, after applying heat for about half an hour, the remaining caustic soda, viz., a quarter, together with a certain amount of silicate and soda carbonate dissolved in water, are mixed. It is again stirred, and a further two hours' continuous heat will thicken the soap. It is then placed into frames, where it is cooled within thirty-six hours. It is taken out in the form of blocks, and then cut into bars and cakes.

Raw Materials Used.—The oil chiefly used in this process is coco-nut, which possesses a high saponification value. Linseed oil, castor oil, Mahua oil, and other vegetable oils are also often mixed to reduce the cost of production, and resorted to more commonly when the price of coco-nut oil rises above the normal. Other materials used are: Rosin, Perfumes, Dyes, Caustic Soda, Lime, Sajji, Meda, etc. The last three, because of their cheapness, are generally used in the preparation of washing soaps.

The following table will give an idea of the total consumption

of these raw materials, their current wholesale prices, and the places where they come from:—

Raw Materials	*Total Quantity Used*	*Rates*	*Places from Which Imported*
		Rs. a.	
Coco-nut Oil ..	3,000 md. ..	20 0 per md. ..	Cochin (South India).
Tallow ..	2000 „ ..		Local
Castor Oil ..	300 „ ..	12 0 „ „ ..	Agra, Shahjehanpur (U.P.)
Mahua ..	1000 „ ..	13 0 „ „ ..	Agra, Cawnpore (U. P.).
Neem Oil ..	125 „ ..	14 0 „ „ ..	Local.
Lime ..	500 „ ..	1 4 „ „ ..	Dehra Dun.
Sajji ..	200 „ ..	5 0 „ „ ..	Multan.
Mustard Oil ..	105 „ ..	13 0 „ „ ..	Local.
Rosin ..	40 „ ..	13 0 „ „ ..	Bareilly.
Soda Silicate ..	65 cwt. ..	12 0 per cwt. ..	Calcutta & Foreign.
China Clay ..	60 mds. ..	5 0 per md. ..	Orissa.
Caustic Soda ..	88 cwt. ..	19 5 per cwt. ..	Foreign.
Soda Carbonate ..	400 md. ..	7 0 per md. ..	England.
Meda ..		0 2 per seer ..	Local.

Scents.

1. Foreign	..	350 lb.
2. Desi or Country		1,500 lb.
(*i*) Keura	..	2-0 per lb.
(*ii*) Ilaichi	..	0-8 „ „
(*iii*) Khas	..	40-0 „ „
(*iv*) Rose	..	2-0 „ „

Plant.—The process of manufacture is so simple that no elaborate plant is required. All that is wanted are a few cylindrical vessels for dissolving soda caustic, a pan for mixing the oil, caustic soda solution, and some frames for cooling the soaps. One stamping machine worked by hand and a small wooden cutting machine are also required. The former costs about Rs. 150, and can turn out 9 maunds daily; the latter costs Rs. 12, and is made locally. Each work shop keeps from ten to twelve frames and a number of dies. The prices of frames vary from Rs. 5 to Rs. 12, according to size and quality. Besides, there are a number of inexpensive tools in big firms, like hammer-stirrers, "khatkashes," etc. The total value of all the implements would come to Rs. 500 at a rough approximation.

Labour Conditions.—Skilled workmen are themselves the owners of factories. They engage workers sometimes on a monthly pay varying from Rs. 12 to Rs. 25, and sometimes on daily wages ranging from 6 to 12 annas per day. The total number of workers engaged in this industry is about seventy, including the business-men who own factories. The number the latter is twenty-seven. Before 1921 it is said as many sixteen workers used to work in each factory; now there is hardly an average of four.

Varieties of Soaps Manufactured.—Generally two kinds of soaps are made: (1) Toilet, and (2) washing, soap. Some efforts were made to prepare shaving soaps, but they were given up as they were not appreciated.

Among toilet and washing soaps there are certain varieties, each having different prices. The following table will indicate the variety or quality and its selling price:—

WASHING SOAP

No.	*Selling Price*	*Remarks Regarding Quality*
1.	Rs. 5 per maund	75 per cent water and cheap oils
2.	Rs. 11 per maund	30 per cent water and cheap oils
3.	Rs. 15 per maund	Water contents less: quality good

TOILET SOAP

1.	(12 cakes in box)	Rs. 4 ..	30 per cent water and adulterated material
2.	(12 cakes in box) Turkish Bath	As. 9 to Re. 1-8 ..	20 to 30 per cent water: mostly coco-nut oil
3.	(3 cakes in box)	As. 2 to 7 ..	22 per cent water: coco-nut oil: good scent
4.	(3 cakes sn box) Special Quality	Annas 10 to 12 ..	18 per cent water pure coco-nut oil: good scents

The quality of soaps depends very much on the water contents and on the purity or impurity of the materials used. Cheap soaps contain a large amount of water and adulterate materials, and high-quality toilet soaps contain the minimum amount of water and pure coco-nut oil. The latter are more durable.

Outturn.—The monthly outturn of toilet soap, including all varieties, is about 390 maunds, which, when sold at an average of Rs. 20 per maund, comes to Rs. 7,800 in value, or Rs. 93,600 annually. The total output of washing soap is 900 maunds a month, and is valued at Rs. 7,200, or Rs. 86,400 annually. The output of toilet soap has decreased. Before 1925 the total production of toilet soap was valued at Rs. 12,000 a month. This means a fall of 33 per cent in total production. The production of washing soap is, however, increasing as khaddar cloth, which has come into vogue, gets dirty very soon and has to be washed frequently.

Cost of Production

The following figures will give an idea of the cost of production of an average firm on its daily outturn. The factory-owner prepares every day 4 maunds of washing soap of two different qualities and 2 maunds of toilet soap:—

Inferior Dhobi Soap, 2 Maunds

Raw Materials

			Rs.	a.	p.
Coco-nut Oil ...	... 6 seers ...	...	3	0	0
Meda ...	... 6 seers ...	...	0	12	0
Caustic Soda ...	... 9 seers ...	...	3	12	0
Salt ...	... 2½ seers ...	...	0	2	6
Rest Water					
			7	10	6

Superior Quality Dhobi Soap, 2 Maunds.

Raw Materials

Coco-nut Oil ...	... 5 seers ...	...	2	12	0
Mahua ...	... 28 seers ...	...	9	10	0
Castor ...	... 7 seers ...	...	2	3	0
Caustic Soda ...	... 10 seers ...	...	4	0	0
Silicate ...	... 10 seers ...	...	2	4	0
Carbonate Soda	... 2 seers ...	...	0	5	0
Rest Water					
			21	2	0

For 2 maunds the cost of production of toilet soap would be Rs. 42-3-6 approximately.

Total Expenses of Raw Materials on All Kinds of Soaps

1. Dhobi Soap, Inferior Quality	...	...	7	10	0
2. Dhobi Soap, Superior Quality	...	...	21	2	0
3. Toilet Soap ...	...	...	42	3	6
	Total	...	70	15	6

Other Expenses (Common to All)

	Rs.	a.	p.
Labour	4	0	0
Fuel	1	0	0
Rent	1	0	0
Light	0	2	0
Boxes & Labels	9	8	0
Depreciation & Miscellaneous	1	4	0
Total ...	16	14	0

Total Expenses on All Items Rs. 88-9

Selling Prices

1. Dhobi Soap, Inferior Quality at Rs. 5 per maund	10	0	0
2. Dhobi Soap, Superior Quality at Rs. 12 per maund	24	0	0
3. Toilet Soap, at Rs. 30 per maund	60	0	0
Total Income ...	94	0	0
Total Expenses ...	88	9	0
Profit.......... ...	5	7	0

The profit to the factory-owner is not even $6\frac{1}{4}$ per cent; there should be an increase at least to 15 per cent.

Marketing.—Meerut soaps are mostly exported to the various towns of the United Provinces and Bihar. Local sales are not much. The sales are wholly Indian.

The system of marketing is nothing peculiar. Either the foreign merchants themselves come and take as much goods as they require, or they send orders to the manufacturers who supply them by V.P.P. Credit is also granted in certain cases. Sometimes the manufacturer himself visits places and secures orders. Another method of marketing is the taking of shops to fairs and exhibitions, where considerable sales are effected. There is practically no advertisement.

Present Position.—The market is dull, and sales have much gone down. Before 1928 the condition of the industry was highly satisfactory. The output, it is said, was four times more than it is now. The present business depression has given a further set-back to this industry. Apart from business depression, the chief cause of the decline of Meerut soaps is the competition they are faced with both from the "cold process" and "boiled soap." During

these three or four years small soap factories have sprung up in a number of places. Delhi has lately become an important centre for the manufacture of cold-process soap, and is now seriously competing with Meerut soaps. Merchants who come to Delhi for getting other requisites of business purchase soaps also from there, and do not come to Meerut specially for this purpose. The boiled-process soap is a growing menace to the cold-soap industry. Boiled soaps are produced much cheaper, and are better in quality; such soaps are now produced both inside the country, and are also imported from outside. They have succeeded in displacing, to a great extent, cold-process soaps from the markets. Though for the manufacture of washing soaps and toilet soaps of very inferior quality the "cold process" may continue to be adopted, yet for high-quality toilet soaps it evidently cannot stand before the "boiled process" for the following reasons:—

(1) It is difficult to turn out a perfectly neutral soap. A soap containing any free caustic is liable to act injuriously on delicate skins;

(2) Owing to the presence of glycerine, and to the fact that they are made usually of liquid oils, cold-process soaps are likely to sweat on exposure to moist weather although the quality remains the same;

(3) The difficulty of producing a genuine soap which can compete with boiled and milled toilet soap when the price of coconut oil rises beyond a certain figure, this oil being almost essential to the process. This is more or less the position at present as regards cheap toilet soaps;

(4) Glycerine, which is a valuable product, is lost by this process as it is retained in the soap, and not separated as in the boiling process;

(5) It is a kachha soap and wears out easily; and

(6) The process involves wastage; otherwise it could be utized in the boiling process by the machine.

Owing to these limitations, manufacturing soaps by the cold process is neither profitable to the manufacturer, nor to the liking of the consumer. Some manufacturers do want to change the system of production, but monetary consideration stands in their way. If they get the money required or the machines they need, they would unhesitatingly take up the boiling method. There are some manufacturers who are illiterate and conservative. They would not like to change this system unless they see others gaining advantage by it. They cannot initiate, but can only imitate.

Suggestions for Improvement.—There is a great scope for the development of this industry. Soap, to the value of 1 crore and 67 lakhs of rupees is annually imported from foreign countries. To this extent the sales of Indian soap can well be pushed. Foreign

soaps are full-boiled soaps; and, so far from ousting foreign material, it is necessary that good soaps, by the hot process, should be prepared. For the improvement of the Meerut soap industry I would therefore suggest the introduction of machines for manufacturing soap by the boiled process: for this process we require both steam and electric power, the former for boiling, and the latter for converting base soap into toilet soap. For the installation of both and steam electric plant a sum of about Rs. 12,000 is required—Rs. 5,000 for electric, and the rest for steam plant. This amount is too huge to be met by any individual soap-maker. For the achievement of this, two types of schemes may be put forward—

One would be for the establishment of a central factory which would supply base soap to its constituent toilet soap factories, whose owners would be shareholders or members of the central organization. Thus the amount of capital required would be shared by a number of soap-makers, instead of by one. This can be started with a capital of Rs. 18,000, including the cost of working expenses. Full details of machinery and working are given in a separate note.

The other suggestion would be for the establishment of a self-contained toilet factory, each factory maintaining it separate entity. It would manufacture its own base soap by fuel heat, without the use of boiler and steam. The total capital required in this case would be about Rs. 5,000. The details of the scheme are given separately.

Practicability of the Above Two Schemes.—The establishment of a central factory would certainly be more advantageous and economical, but it requires co-operation on the part of several existing factories which does not seem to be possible in view of prevailing trade jealousies. Another difficulty in the way is the ignorance of manufacturers regarding the use and working of machinery.

Though these are great obstacles, there is one hopeful sign. There is a trade association at Meerut known as the Beopar Mandal. It has a certain number of soap-makers as members. Being an institution of progressive ideas, it may be in a position to induce soap-makers to form a co-operative organization for the establishment of a central factory. This organization may be a branch of the mandal itself, and should take up the scheme in its own hands and start a factory. Among other functions of this organization would be—

(1) to finance individual members;
(2) to keep in touch with buyers of finished products and suppliers of raw materials; and
(3) to employ a technologist to help soap-makers in solving technical difficulties, if any, and to suggest improvements from time to time.

Having an established credit, there would be no difficulty for this association in arranging for the capital required for starting a factory.

In case all attempts for a central factory prove futile, the second alternative of a self-contained factory may be given effect to. As stated above, it would require a capital of Rs. 5,000, which no manufacturer at present is in a position to invest. Rs. 3,000 of this amount would be required for machines: if they get these machines on the hire-purchase system from Government or from machinery dealers, they can easily afford the rest of the amount themselves. This scheme, considering the present circumstances, is the more practicable. When a number of such factories are established, and the manufacturers become familiar with the use of the machines, they will themselves appreciate the idea of a central factory for the manufacture of base soaps.

Details of Central Factory Scheme.—The central factory will produce 30 tons of base soap per month, and will supply to seven constituent toilet soap factories 3 cwt. daily.

Initial Outlay on Machines

	Rs.	a.	p.
1. Boiler	1,500	0	0
2. Storage Tanks	1,000	0	0
3. Boiling Pans	1,500	0	0
4. Pumps	500	0	0
5. Soap Collers	1,000	0	0
6. Fittings, etc.	1,000	0	0
Total Rs. ...	6,500	0	0

Working Expenses

Tallow	... 154 Cwt., at Rs. 20 per Cwt.	...	3,080	0	0
Mahua Oil	... 210 " " 19 " "	...	3,990	0	0
Coco-nut Oil	... 50 " " 27 " "	...	1,350	0	0
Rosin	... 30 " " 16 " "	...	480	0	0
Caustic Soda	... 72 " " 20 " "	...	1,440	0	0
Salt	... 40 " " 4 " "	...	160	0	0
Chemicals	...	...	32	0	0
Total Cost of Raw Materials Rs.		...	10,530	0	0

Other Expenses

	Rs.	a.	p.
Soap, 10 tons, at Rs. 15 per ton	150	0	0
Labour, 10 Men	200	0	0
1 Technologist	150	0	0
Office Establishment	100	0	0
Laboratory Expenses	50	0	0
Depreciation, at 10 per cent	60	0	0
Rent & Taxes	100	0	0
Interest on Capital, at 10 per cent	112	0	0
Contingencies	125	0	0
Total of Other Expenses Rs. ...	1,047	0	0
or Rs. ...	1,050	0	0

Grand Total of Working Expenses Rs. 10,530 + 1,050 = 11,580
or Rs. 11,600

Soap Produced

600 Cwt. of Soap All Qualities

1st Quality	250 Cwt.
2nd Quality	250 „
3rd Quality	100 „

Selling Prices

1st Quality	at Rs. 26 per cwt.	Rs. 6,500
2nd Quality	„ 23 „	„ 5,750
3rd Quality	„ 20 „	„ 2,000
	Total Rs. ...	14,250

Average price per cwt. Rs. 24.

Profits (Rs. 14,250—11,600) = Rs. 2,650.

Half of this profit, *i.e.*, Rs. 1,325, may be reserved for the payment of the capital of Rs. 18,000 invested.

After one year the payment would be 12×1,326, or Rs. 15,900. Thus the whole sum can be paid back in less than 14 months.

A similar amount would be earned by the shareholders. This may be utilized for reducing the selling price of base soap.

After 14 months the whole amount of profit may be utilized towards the reduction of the price of base soap.

During the first 14 months the average selling price would be $\frac{14,250-1325}{600}$, or about Rs. 22 per cwt. After 14 months, when the loan is paid off, the average price would come to $\frac{14,250-2,650}{600}$, or about Rs. 20 per cwt.

Toilet Soap Factory.—Each toilet soap factory would be supplied 3 cwt. of base soap daily, at Rs. 20 per cwt., from the central factory.

MACHINES REQUIRED FOR TOILET SOAP FACTORY

	£
1. Soap Chipping	15
2. Soap Milling	68
3. Soap Plodder	53
4. Press, without Stamps	28
5. Motor, 7½ H.P.	200
6. Fitting	500
Total ... Rs. 2,750, or	Rs. 3,000
Tools, Equipment, etc., including Plates, Tanks, Dies, Pens, etc. Rs.	2,000
Total Capital Required Rs. ...	5,000

WORKING EXPENSES

3 Cwt. of Soap Daily

	Rs.	a.	p.
2 Men	1	0	0
Perfumes	10	0	0
Boxes, Packing, etc.	20	0	0
Current, 32 Units	3	0	0
Advertisement	5	0	0
Depreciation, at 10 per cent	2	0	0
Rent & Taxes	1	8	0
Interest on Capital	1	0	0
Contingencies	1	8	0
Total Rs. ...	45	0	0
Cost of Base Soap for 3 cwt., at Rs. 20 ...	60	0	0
Total Cost Rs. ...	105	0	0

Selling Price, at Rs. 47 per cwt., or Rs. 35 per maund, Rs. 141. Hence profits, Rs. 141—105=Rs. 36.

Details of a Self-contained Factory

COST OF PRODUCTION

3 Cwt. of Soap Prepared in 8 Hours

			Rs.	a.	p.
Caustic Soda	... 10 Seers	... ...	6	8	0
Coco-nut oil	... 1 Cwt.	... ...	30	0	0
Castor	... $\frac{1}{3}$ Cwt.	... ...	5	12	0
Mahua	... $\frac{2}{3}$ Cwt.	... ...	12	12	0
Scent & Colour	...	... ...	12	8	0
		Total Rs. ...	67	8	0

OTHER EXPENSES, INCLUDING COAL

Coal, $2\frac{1}{2}$ maunds	4	0	0
Current, 32 Units	3	0	0
Wages	5	8	0
Establishment & Rent	3	0	0
Packing, etc.	20	0	0
Advertisement	5	0	0
Interest & Depreciation	2	8	0
Contingencies	1	8	0
Total Rs. ...	44	8	0
Total expenses come to Rs. ...	112	0	0
Selling Price of 4 maunds, at Rs. 35 per maund Rs.	140	0	0
Profit ... ... Rs. ...	28	0	0

A comparison of the profits earned per day by each of the two factories clearly establishes the advisability of having a central factory. In addition to this, the quality of the toilet soap manufacture under the central factory scheme would be much better than that produced by the direct fuel heating process.

OTHER SUGGESTIONS

1. Facilities may be provided for short courses at the Technological Institute, Cawnpore, to train professional soap-makers, as is done for professional dyers and printers in dyeing and printing schools.

(*Continued on page* 314)

PRACTICAL HINTS ON VEGETABLE CULTURE IN INDIA

By "Sherrard"

Part VI

Celery.—Harvesting period P. January-March; H. July. Of all vegetables it is with celery that the amateur appears to have the least success on the plains. This is really due to the peculiar germinating power of the seed. Their "will" to germinate is most erratic. They will germinate readily enough in November, when the weather is cold, but the resulting plants will never come to perfection, and will be fit to use only as a herb. It is essential that good, stocky seedlings are ready to go into the ground in October. This is only possible when germination is secured in July or August—the earlier the better.

The essential condition for successful germination is cool weather. The most favourable time to sow (under cover) is at the beginning of a long cool spell of rainy weather. Should this condition prevail at the time of sowing and continue for a week or so after, the seeds are almost sure to germinate satisfactorily. If the weather suddenly changes to dry and hot immediately after sowing, anything may happen to the seed. They may never germinate, or they may remain dormant in the soil for months and then suddenly spring to life. And yet a second sowing during favourable weather, immediately after the first sowing, will germinate within a few days of sowing.

Every endeavour must be made to sow during favourable weather, and successive sowings should be made at every opportunity throughout July and August. For this reason you will require more seed than is really necessary in order to "catch" the favourable time. As this cannot be ascertained with any reasonable amount of accuracy, successive sowings must be made whenever the weather appears favourable.

Sow in pans, and as soon as the plants are big enough to handle, they are first pricked out into boxes or pans, and then again, when they are a couple of inches high, potted off singly into tiny pots. Later they are transferred to the ground.

The soil should be rich, friable, and well drained. The seedlings are planted in a single line down the middle of the bed. The instructions given for blanching Cardoon should be followed for Celery. The blanching will be completed in fifteen to twenty days. A mistaken idea prevails that blanching should be done gradually as the growth increases. This not only renders the stems thin and weak, but makes them tough and unfit for use. Moreover, the growth is checked, and those that survive the process are apt to decay. But on no account should the blanching be delayed till

the plant has grown to a considerable size as the stems will then be hollow and practically worthless.

When the plants are about 6 inches high, a 1 to 4 mixture of nitrate of soda and earth applied to the roots by the "Sandwich" process will stimulate the plants and encourage the production of thick, succulent stems.

Celeriac.—Harvesting period as for Celery, but, where good heads of these can be raised, the cultivation of Celeriac is not worth while. No blanching required, but otherwise the seeds and seedlings are treated in the same way as Celery. The roots are used in soups, etc., and the leaves for flavouring.

Chervil, Bulbus.—Harvesting period P. February-March; H. June-September. The thick, fleshy, tapering root is cooked and eaten like the Sweet Potato. Method of cultivation as for Carrots.

Chilli.—Harvesting period P. July-March; H. July-October. Any good soil. Of easy culture.

Corn Salad.—Harvest period P. January-March H. July-October. Much relished by th French people as a salad. Of easy culture. Any good soil.

Cress, Garden.—Harvesting period a few weeks after sowing. Cut when 2 inches high. Sow at short intervals. A favourite salad plant. Of easy culture, but soil must be kept moist by frequent surface waterings.

Cress, Water.—Harvesting period a few weeks after sowing. Can also be propagated by dividing old plants and planting these 6 inches apart each way.

The bed should be made somewhere near the source of the water-supply with a gentle slope. Along the higher side of the bed a masonry trough is built running along the width of the bed. This trough need only be 6 inches deep and 6 inches wide. The wall nearest the bed should be an inch lower than the other three walls.

The water is run into this trough and allowed to escape over the lower wall throughout its entire length, in a gentle trickle, into the bed, through which it should flow gently and escape out at the other end. It is essential that the lower wall of the trough be plumb-level so as to allow for a uniform flood of water through the bed over its entire width. The water at the outflow should be run into a drain, from where it can be diverted in any direction required.

The seed should be sown broadcast and sprinkled over with light sifted soil, and immediately watered with the watering-can through a fine rose, after which running water should be allowed to flow over the bed for about ten minutes every hour or so. When the plants are about an inch high, the outflow should be banked up

with earth so that the bed holds about half an inch of water. Water should now be allowed to flow through the bed morning and evening for an hour each time; but, if a continuous stream of water can be directed through the bed all the time, or at least all day, so much the better for the plants. Stagnation spells failure. When the bed is planted out by division of old plants, a continuous supply of water should be run through the bed for the first three days.

Egg-plant.—

October Sowings.—Sow in seed-beds, transplant to nursery-beds when 2 inches high. Protect from frost at night. Transplant these in the same beds at least three times, allowing more space between the plants each time, before February, when the plants are planted out in the open. If they are left in the nursery-beds without transplanting, they develop into long, weak plants. Where there is no danger of frost, the plants may be transferred from the nursery-beds into the open ground in November or December. Harvesting period March-June.

February-March Sowings.—Sow in seed-beds, transplant to nursery-beds, and then plant out in the open beds. Harvesting period May-August.

June Sowings.—Same treatment as above. The plants are apt to die out if waterlogged at this time of the year. Harvesting period September-November.

The most productive plants are those raised from October sowings. Soil rich. Guard against checking the growth of the plants when transplanting. A severe check will greatly reduce the crop. For this reason the plants should be transplanted wide apart in the nursery-beds and a large ball of earth taken out each time they are moved. If pots can be used, there will be less danger of injury or check to the plants.

Endive.—Harvesting period as for Lettuce, and when these are plentiful Endive is not required. But it is much more hardy than Lettuce, and would therefore be useful on the hills as a winter salad. Of easy culture. Seeds acclimatize readily.

When the plants are nearly full grown, they are blanched, beginning with the most advanced plants. Blanching is conducted in various ways. The leaves are tied together loosely, and an inverted flower-pot is placed over the plant. As darkness is essential, the hole in the pot must be stopped up. Another method of blanching is to spread the plant out flat on the ground and cover it over with a flower-pot in such a manner as to allow the tips of the leaves to peep out from underneath. A few pieces of broken pot should be inserted under the flower-pot to prevent it from

pressing too heavily on the plants. Blanching is completed in ten to fifteen days.

Garlic.—Harvesting period April. The Cloves or Bulbils, obtained by dividing the nature bulbs, are planted an inch deep. Of easy culture. Soil ordinary. When the leaves turn yellow and die down, the crop is dug up, dried, and stored. Cheaply purchased, and therefore not worth growing.

Ginger.—Harvesting period January-February. Tubers divided and planted 2 inches deep. Soil ordinary. When the roots are well ripened, they are dug up, cleaned, dried, and stored. Cheaply purchased, and therefore not worth growing; but, if required for preserves, must be grown for the purpose. The roots, in this case, are dug out when they are young and tender, i.e., when the plants are about 5 or 6 inches high. The preserve is made in the following manner:—

First scald tubers, wash in cold water, and scrape the peel off completely. Make a syrup of a pound of sugar to a pint of water to every pound of ginger and into this gradually add the beaten whites of two eggs, stirring all the time. Boil and skim the syrup, and, when cold, pour it over the ginger. Allow it to soak for three days. Pour off the syrup and boil and skim again. When cold, again pour it over the ginger, and allow it to stand for another three days. Proceed as before, but this time pour the hot syrup over the ginger. Continue this process until the complete penetration of the syrup is effected, which can be judged by taste, and till the syrup becomes thick and rich. If the hot syrup is poured over the ginger in the first instance, the ginger will shrivel.

Ground-nut.—Harvesting period December-February. Of easy culture. Soil rich, sandy, and well drained. The seeds are sown 2 inches deep. As soon as the leaves begin to turn yellow, all watering is stopped and the soil allowed to dry out. When the shells are well filled, the nuts are dug out and stored.

Horse-radish.—Harvesting period April-August. Does not succeed on the plains. The fleshy root is shredded or grated and used for salads or soups. Soil damp and heavy. The root should be straight and thick, not twisted. Propagated by planting pieces of root about 1½ inches long 6 inches below the ground. Each piece should be cut so as to have one "crown" or "bud," and, when planted, these should face upwards. The plant is a perennial.

The Horse-radish tree (Moringa pterygosperma) grows on the plains, and the roots make a very good substitute for the real Horse-radish, from which it is not easily distinguishable. Seeds of this tree sown in March will produce roots large enough for use in October. The tree is also easily raised from cuttings planted just before the rains begin.

Knol Kohl.—Harvesting period P. December-March; H. May-August. Follow the same general culture instructions as for Brussels Sprouts and Cabbage. Of easy culture. Method II may also be employed. The Knol Kohl is a vegetable which combines the flavour of the Cabbage and the Turnip. The turnip-shaped bulbs should be cut for use when half grown; if they are allowed to mature, they will be tough and stringy. The purple variety is best for table use. It is one of the earliest European vegetables of the season.

Lady's Finger.—Harvesting period P. April-October; H. July-October. Soil ordinary. To maintain a supply of pods, sow once a month. The American varieties are the best. The fruit should be picked every few days when quite young and tender; the plants cease bearing if any of the pods are allowed to mature on the plant. Avoid cutting off the tip of the stem when picking, otherwise further production is retarded.

Leek.—Harvesting period P. February-March; H. July-September. In the tabular statement method BI is shown for this vegetable, and this will answer when small, tender stems are required. The seedlings are planted down the centre of the furrows, and, when about a month old, a little earth is drawn up around the stems. The seedlings should be planted rather deeply. As the plants grow, this *earthing up* is continued until the stems are covered with 6 or 8 inches of soil. About two to three weeks after the last *earthing up* the fleshy stems are ready for use. This method of "gradual" blanching, though suitable to Leeks, will not suit Celery on the plains. Leeks are gross feeders, and the soil should therefore be heavily manured. When transplanting, cut the leaves well back; and, when growing vigorously, cut off the growing tops occasionally to induce the roots to thicken. Leeks, when boiled and served with melted butter, have little or no Onion-like flavour. A little saltpetre applied to the soil before planting will greatly benefit the plants.

When a great length of blanched stem is required, the method of cultivation is slightly modified. Trenches are prepared as for method D, but they need only be a foot wide, the depth (2 feet) being maintained. These trenches are half filled with equal quantities of earth and manure, the upper half of the trench being left empty. When the seedlings are strong enough, they are planted 12 inches apart in a single line in the half-filled trenches. As the plants make progress and the stems increase in height, the blanching is begun by filling in a little of the earth from the sides. This *earthing up* is continued until all the earth has been filled into the trenches and the Leeks are fully grown, only the tops showing above the ground.

It is most necessary that water should reach the roots, which

remain deep down as the blanching process proceeds, otherwise their development will be checked and they will not reach full size. To accomplish this, earthen drain-pipes are inserted along one side of the trench, and these are filled with water once a week.

Feeding is also an important item. Every second week these pipes are filled with liquid farmyard manure. When the plants are half grown, the following fertilizer mixture is applied along both sides of the plants using 2 ounces per yard run of row:—

Superphosphates of lime	...	...	5 parts
Sulphate of ammonia	...	...	3 parts

Failure to produce good Leeks is generaly due to insufficient feeding, planting on poor soil, and lack of moisture at the roots.

Lettuce.—Harvesting period P. October-March; H. April-November. Soil rich, yet light and deeply dug. Bonemeal at the rate of 2 ounces to the square yard is most beneficial, and should be applied a month before planting, followed in fifteen days by a dressing of lime at the rate of an ounce to the square yard. Both these should be turned in with a garden fork.

The seed will acclimatize readily, but seed should only be collected from plants which were raised from seed sown between the middle and the end of October on the plains. Careful selection is necessary, collecting seed from only those plants which have formed good hearts.

When the plants are nearly fully matured, the more forward ones should be induced to form a heart by drawing the leaves together and tying them loosely together. Only a few should be taken up at a time, and they should not be kept tied in this position longer than ten days or so. When sown in October and November on the plains, and provided the strain is good, this operation will not be necessary as most of the better kinds are self-blanching.

Though in the tabular statement these seeds have been shown as belonging to class I, equal, if not better, results are often obtained by sowing the seeds in their permanent positions and thinning out to a foot apart.

The secret with Lettuce is to grow them without a check from the start, otherwise the leaves will be tough and will produce a bitter flavour. For this reason they should never suffer from want of water or feeding, and should preferably be sown at site. Transplanting will also cause them to mature at least fifteen days later than those sown in situ. If the soil is not sufficiently rich, feeding with liquid farmyard manure will be necessary.

Maize.—Harvesting period P. August-September; H. June-August. The indigenous varieties are hardly worth growing as a

vegetable. Imported varieties from Australia and America are tender and of good flavour; the cobs, however, are not well filled the first year on the plains. They degenerate very rapidly in this country. Soil rich, somewhat heavy. The plants require copious watering from the earliest stages.

Where there in no danger of frost, a sowing may be made in September for winter use. On the hills imported seeds produce crops equal in all respects to those grown in the country of origin.

The cobs, while in their milk stage, should be prepared for the table immediately after harvesting.

Mushroom.—I have only once seen Mushroom growing successfully on the plains under artificial treatment, and give below a description of how the beds were prepared and the fungi cultivated.

A lean-to shed which faced north was built against a wall. The side "walls" consisted of thick grass *tatties* through which no light could penetrate. The roof was of country tiles. The front was closed by grass *tatties* made somewhat lighter than the sides, through which a very little diffused light could penetrate. The shed was 25 feet long and 10 feet wide.

A series of raised beds were built running from the front to the back wall. These were 2 feet high and 3 feet wide, with a space of 2 feet between each. The walls of these beds were built of brick, a single brick in width resembling long empty troughs, and were faced with several holes to permit of drainage. The floors of the passage-way between the beds were paved with brick, with a slight slope towards the front.

These masonry troughs were filled as follows: Broken pots and tiles were placed at the bottom to a depth of 6 inches to allow for perfect drainage. The remaining space was filled to within an inch of the top with the following mixture:—

Horse droppings free from all straw, etc., partly decomposed and still retaining heat ...	6 parts
Cow-manure thoroughly decomposed ...	2 parts
Loam	1 part

After active fermentation had ceased an inch of loam was placed over the mixture. The temperature was taken occasionally; and, when found to be between 70° and 80° Fahr., the spawn was sown, after which the beds were covered with another inch of loam, beaten down firmly, and finally covered with a little hay. The spawn was broken into pieces about 2 inches square and sown 1 inch deep and 9 inches apart at the end of July. The temperature was taken by probing holes in the compost and inserting a long thermometer.

The beds were sprinkled occasionally with warm water to keep them just moist, but not wet; within two months the beds were covered with Mushrooms. Occasionally the beds were sprinkled with warm water to keep them moist, but dampness and humidity were maintained by keeping all the walls and floor damp.

Excessive moisture in the beds is to be avoided, and the temperature inside the shed should not fall below 50° Fahr.

On the hills the Mushroom can be cultivated successfully under the above treatment.

Mustard.—Harvesting period a few weeks after sowing. If small quantities are required, sow in boxes. Cut for use when 2 inches high. Of easy culture. Seeds should only be saved from plants which were grown from seed sown in October. These should be sown in lines 2 feet apart and thinned out to 1 foot apart.

Onion.—Harvesting period P. March-April; H. September-October. Soil heavy loam. Patna is famous for its onions, and the two acclimatized varieties obtainable from there are strongly recommended for the plains. One is known as the Silver-skin Onion, and the other the Red Onion. In the tabular statement the seeds are classed as class II, but equal, if not better, results are obtained by sowing in situ, thinning out to the required distance apart. When the bulbs are ready for lifting, all watering should be stopped. When the leaves are completly withered, the bulbs are ready to be taken up. Copious waterings are, however, necessary when the plants are growing, otherwise "doubles" will be formed.

Though the Onion can be grown in a soil that has been moderately manured, a rich soil tends to give them a milder flavour. When full grown, only sufficient water should be given to keep them alive. Overwatering at this stage tends to encourage thick necks, instead of sound bulbs. Cutting off about a third of the growing top, when full grown, will help to develop and ripen the bulbs.

Onions for pickling should be grown closely together about 3 inches apart each way.

Imported seeds are apt to fail as they do not keep well.

For seed purposes, bulbs should be planted in rows 18 inches apart and 1 foot apart in the rows on the plains in October. Only sound, well-shaped bulbs should be selected. The tops of these should be cut off with a sharp knife, leaving about two-thirds of the lower portion for planting. Much stronger flower shoots are assured by this method than if planted entire.

Parsnip.—Harvesting period P. February-March; H. June-August. Cultivation as for Beet and Carrots. It is important that special arrangements be made to secure seeds harvested in Europe in August or September and sown here in October or November because they do not retain their germinating powers longer than three or four months.

The drills in which the seeds are sown should be filled with sand to a depth of 2 inches and the seed sown in the sand. This ensures successful germination.

Can be grown on the hills nearly all the year round.

Pea.—Harvesting period P. January-February; H. April-July. Should not be sown on the plains until the weather is cool. Young plants, the result of too early sowing, are prone to a fungus disease to which they easily succumb. This disease sometimes attacks the plants when they are but a few inches high, while at other times they may grow 2 or 3 feet before they are attacked. On the plains sowings should be deferred till November, or until there is a crispness in the air at night. Soil friable, rich loam.

Bonemeal worked with the soil before sowings, at the rate of an ounce to every yard of trench, will give good results. Lime is also essential.

Sow in moist soil; and, if the surface soil should dry out, sprinkle daily till the seedlings are 2 inches high, when the trenches should be flooded with water. They will not stand water-logging. Strong stakes will be required to support the tall-growing varieties. Acclimatized seeds degenerate after three or four years.

Use a pair of scissors for cutting off the pods. Wrenching the stems will cause much damage.

Potato.—Harvesting period P. December-April; H. July-October. Soil rich, friable, and well drained. On the plains tubers or sets, acclimatized on the plains, are planted from the 15th September to the 15th October. Imported tubers or those obtained from the hills are planted from the 15th November to the 15th December. It is now generally agreed that the best tubers for planting are the medium size, about 2 inches in diameter, avoiding both the small ("seed") potatoes and the large tubers. They are best planted entire.

It is most important to obtain good tubers for sowing. Local-sown tubers, unless grown in a section known to produce good crops, should not be used for sowing purposes. Unless rigidly selected, there is rapid degeneration in potatoes.

As a rule, no irrigation is necessary after sowing until the

plants are about 6 inches high. As soon as the plants have grown to this height, the earth is drawn up against the stems and the water is then directed into the channels thus formed. The soil around the stems of the plants and where the tubers are forming should never be flooded as this results in misshapen tubers. The object should be to give light, but frequent, waterings, instead of heavy floodings at long intervals.

When the leaves begin to assume a yellow colour, the crop is nearing maturity. Water should then be withheld until the plants are quite withered up, when the crop is dug up and stored.

Radish.—Harvesting period September-February; H. April-September. Soil rich, friable loam, but not recently manured. Cultural instructions as for Beet and Carrots. Sowings to be made at intervals of ten or fifteen days to ensure a constant supply of young tender roots.

The long, white, acclimatized variety can be sown on the plains as soon as the rains break, but the imported varieties should not be sown before the middle of October, otherwise they will be tough and hardly fit for use. When grown for seed purposes, the best-developed roots are selected from October sowings. A third part of the root is cut off, leaving the upper two-thirds for planting, from which the leafy top is also cut away. These crowns are then planted 3 feet apart each way in fairly rich soil. About an inch of soil should cover the top.

Rhubarb.—Grown only on the hills above 5,000 feet. Soil deep, rich and moist, but well drained. The plant is a perennial, and requires a mulch of farmyard manure two or three times a year worked into the soil around the roots. Rhubarb is a gross feeder. The crop may be cut from established plants at least two years old; they will continue to yield good stems for a number of years. The largest of the leaf stems should be pulled out for use, leaving sufficient stems to keep the plants in a healthy condition. The stems should be pulled out, and not cut. The plants should never be allowed to flower. Propagated also by division of roots.

Red Sorrel.—Harvesting period December-January. The fleshy calyx of the flower is used for making a jelly not unlike red-currant jelly in taste, for which it makes a good substitute. Soil moderately rich. Of easy culture.

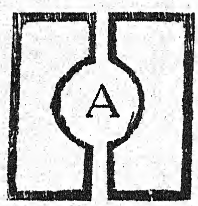
Salsify.—Harvesting period P. February; H. October-November. The fleshy roots, which somewhat resemble a Parsnip, are first stripped of their outer skin, soaked in vinegar or lemon-juice, and then boiled and served with white sauce. The flavour resembles that of the oyster. Of easy culture. Thrives in any good soil. Acclimatizes easily on the plains. Requires the same treatment as the Parsnip.

Sea-kale.—Harvesting period P. February-March; H. April and July-August. Not very successful on the plains. Propagated by division of roots and also by seed; the former method is the only practical one on the plains. Cultural instructions as for Rhubarb. When each plant has died down, each crown is covered with an inverted flower-pot that has had the drainage hole stopped up. Litter is then covered over the pots to retain warmth. Within three to four weeks the shoots will be ready for use.

Shallot.—Harvesting period P. March-April; H. June-July. Propagated both by seed and bulb. The bulbs are used for the same purpose as Garlic. Soil light and rich.

Strawberry.—Harvesting period P. March-April; H. April-June. It is essential that the soil be thoroughly dug and richly manured before planting. Once the suckers are planted, continuous tillage is necessary, but the soil around the roots should never be deeply dug as the plants are shallow-rooted. A dressing of bonemeal should be given to the roots annually a month before they bloom, after which a heavy mulch of litter is necessary. This will keep the fruits clean, conserve moisture, and benefit the plant in many ways. An excellent composition in rolls is now obtainable from Messrs. The Ellerman Arracan Rice and Trading Co., Ltd., Calcutta, known as Pebco Mulch, which is far superior to any other mulching material. It is not attacked by white ants, and is clean and easy to handle. A strip may be cut from the roll 18 inches square and a 3-inch hole cut in the centre of this square. The strip is then cut down the centre to make two pieces. These two pieces are so placed under the stems of the plants, to lie flat on the ground or to take the shape of the ridge, in such a manner that the plant grows through the hole made in the centre.

Thus:



A is the hole in the centre of the strip through which the plant grows.

On the plains the *runners* or young plants are planted out from the 15th October to the 15th November, while on the hills they are planted in September and October or from February to April. The plants, after fruiting, commence to make runners. Two or three should be retained on each plant if required for fresh planting, and all the others cut away as they appear. Tiny pots or pans should be placed to receive each runner; and, when these are rooted, they should be severed from the parent plant and all the pots collected for future planting. The runners may also be induced to form roots in the ground while still attached to the

parent plant, but greater care will be necessary when removing them.

Though a plantation of Strawberries will continue to bear good crops for two or three years on the hills, on the planis the plants are best treated as an annual, making a fresh plantation each year.

The Strawberry is not equally successful in all districts on the plains. In some localities they do not succeed at all.

Sweet Potato.—Harvesting period October-November. Propagated by cuttings from old plantations, and also by planting the tubers or thickened root stems. These should be preserved for the purpose in sand until required for planting. Cuttings are planted in situ in June, or as soon as the rains have set in, and the tubers in March.

There are two varieties—one with red tubers and the other with white. The former are regarded as the better of the two.

Rich, but light, soil is necessary for the best results. The plant, which is of a trailing habit, is allowed to spread itself over the ground, but the vines should be cut back half their length once or twice, but not more often, during the growing period. This induces thicker tubers. When the vines begin to turn yellow, all watering is stopped; and, when the tubers are properly filled, they are taken up. They should not be permitted to remain in the ground once the tubers have matured. They can be kept in dry sand in an airy room for about six months. During storage a portion of the starch changes to sugar, and therefore the best edible condition is not attained until they have been in storage for about six weeks.

Tomato.—Harvesting period P. October-April; H. July-October. On the plains acclimatized seed is sown in June and July, followed by imported seed in September and October. The plants are sensitive to frost; and, where there is a danger from this source, protection will have to be afforded. For exhibition purposes the plants may be trained to a single stem, thinning out the fruit to half a dozen or so to each plant. The plants require strong stakes 5 feet high to support them. These should be fixed in position at the time of planting out in the open beds, and not left till the plants are of considerable size. As the plants grow, the stem should be secured to the stakes at intervals. The growing ends should be pinched off when the plants have reached the top of the stakes.

Deep, fertile soil is necessary, but not overrich, as excessive nitrogen tends to produce a soft, sappy growth. Short, stocky, hardy plants are necessary to resist disease, but an underfed plant is more apt to succumb to an attack.

Lift each plant with a ball of earth when transplanting. Plants which are injured during transplanting are most likely to suffer from disease. Avoid any check to the plants; keep them growing from the earliest stages.

Potash is very desirable in some form, wood-ashes being very useful on sandy soils. Liquid farmyard manure, when the plants come into flower is also beneficial.

Turnip.—Harvesting period P. August-April; H. June-October. On the plains acclimatized seeds are sown as early as July and throughout August, followed by imported seed in successive sowings from September. Acclimatized seed must be sown early to be successful.

To ensure a continuous supply for the table, successive sowings must be made every twenty days. Cultural instructions as for Beet and Carrots.

Rapid growth is essential to ensure tender bulbs of fine flavour; the soil should therefore be rich and friable.

Turmeric.—Cultural instructions as for Ginger. The plants are *earthed up* when about 8 inches high.

Yam.—A climbing annual with fleshy edible roots. There are numerous varieties. Propagated by planting the bulbous roots, and also by planting the bulbils which are formed in the axils of the leaf-stalks; but these do not produce edible roots till the second year. Plants are also raised from cuttings. Of easy culture. Soil ordinary. Should be planted against a tree or trellis-work upon which it can climb. After the tubers have been boiled they should be buried beneath hot wood-ashes to remove all moisture and to render the bulbs mealy.

(*Concluded*)

(*Continued from page* 301)

2. Electric charges are too high for industrial purposes. The rate should be reduced to 1 anna per unit, as is done in the case of the agricultural industry.

3. The railway freight in regard to coco-nut oil which is imported from outside provinces should be reduced.

4. The import duty of caustic soda should either be abolished or reduced to 5 per cent, instead of 15 per cent, as at present.

5. Cardboard boxes, which are greatly needed by soap-makers for packing toilet soaps, are at present made by daftris, and are naturally not as cheap and well made as those made by machines. A small factory for making cardboard boxes may profitably be started.

These suggestions, if given effect to, will considerably improve the condition of the industry; and the improved condition of the industry will enable it to face foreign competition, and lakhs of rupees which are yearly sent out of the country will be saved.

MODEL SERVANTS' QUARTERS

By Mason Vaugh

Agricultural Engineer

The provision of adequate and suitable quarters for servants and low-paid workers has had too little attention in the past. Most bungalows have had an "adequate" number of so-called servants' quarters attached to them. Most institutions have a considerable number. Municipalities have often provided them for sweepers, etc., but that they have been adequate from the standpoint of convenience and adaptability to comfortable living, or that they provided sanitary living conditions, may be debated. In many cases, the quarters provided are mere hovels not fit for human beings to live in, and dangerous to life and health.

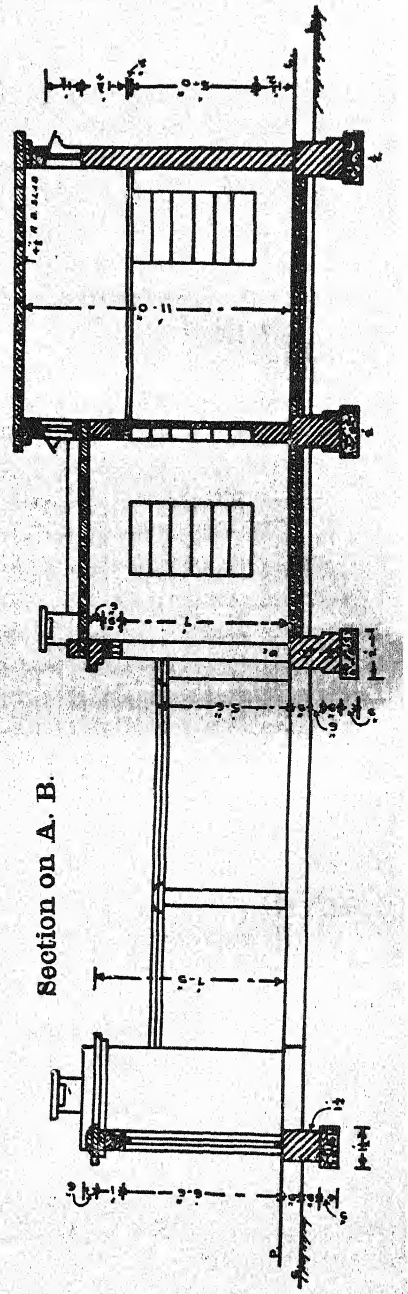
Recent agitation for the removal of untouchability has focused public attention on the problem anew. Many municipal bodies have been stirred to provide something better than the old houses for their servants. Private owners have looked with new sight on the houses in their compounds. Some renovation has been done, but more needs to be done.

The Agricultural Institute has been interested in this problem for some years. Some five or six years ago a tentative plan was drawn up for quarters for dairy staff and other low-paid workers. Lack of funds made it impossible to go ahead with the plans at that time. Recently it has been possible to construct them. It is believed that the quarters, as constructed, have some features of value, and that they may be of interest at this time. They seem to us to be suitable for low-paid workers whether in cities or on farms and in villages.

The quarters built were for milkers and milk-delivery men who have to perform their duties in the night, but are not required to be on duty all night. The men concerned are, some of them, on duty for a couple of hours in the middle of the night, and others go out with milk about 3-30 in the morning. To have them sleep far away in a village means too much risk of their oversleeping and failing to turn up. Having them in the compound makes it possible for them to sleep in peace till their time for duty comes and for a watchman to call them easily.

The necessary requirements were listed as follows: One room not less than 10 feet by 12 feet; a verandah nearly as big; and a court-yard the full width of the room and approximately 20 feet deep. There are many possible arrangements, but the one with a line of houses in a row fitted the site available. It also facilitated the provision of water and the provision of an individual flush latrine for each quarter. This arrangement is liked locally, at least by

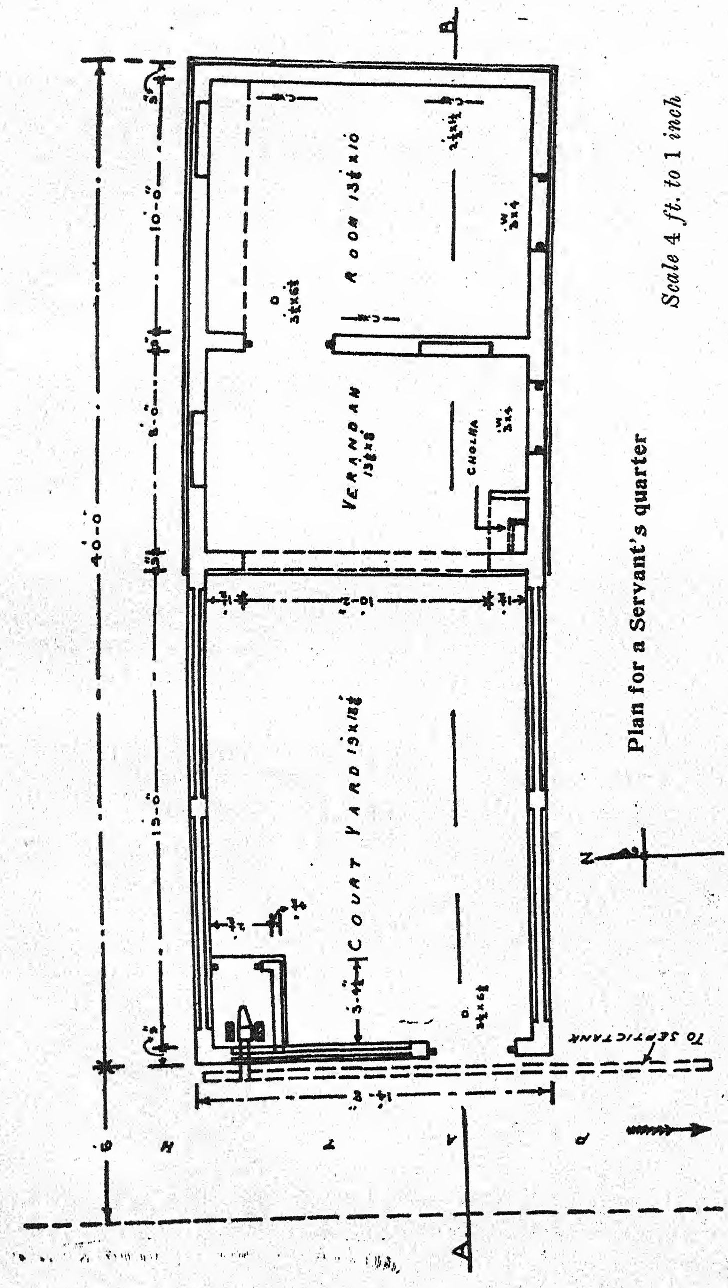
the class of people concerned, as it gives them near neighbours and consequent protection from robbery. Pakka floors and a cooking-place which would carry the smoke out through a chimney were also considered necessary. We felt that it was necessary to build in such a way as to make economical upkeep possible, that is, pakka throughout. In each room a shelf, at the height of the door and the full width of the room and about 2 feet wide, made of brick, is provided. This gives aplace for putting bedding in the daytime out of reach of children, who would climb over it if left on the bed. This is a feature specially requested during the construction by the prospective occupants, and has been very much approved by everyone who has seen it. Except for the first or end unit, each bedroom has two shelf almirahs, and shelf almirahs are also provided in the verandah for food, dishes, etc. The shelves are made of cheap wood and do not add much to the cost, but they do provide a place to keep small possessions. All doors are singleleaf, simple frame, and ply-wood panels, chir (pine) wood being used. Those exposed to weather are heavily creosoted, and the others painted.



Section on A. B.

The people occupying these quarters say they are "model"—that they provide the needed facilities for comfort and privacy; and they are quite satisfied with them. No doubt further improvements can be made in them, but we hope that they may serve at least to inspire others to attempt improvement. The overall cost was estimated at Rs. 900 per unit, using new material throughout. Those actually built were partly from old material salvaged from a dismantled building so the cash cost was considerably less. While Rs. 900 is more than is often spent on such a building, the long-time cost will be low. The building should need little in the way of

repairs or upkeep, beyond whitewashing, for a period of fifty years. The court-yard door, which is more exposed to the weather, may need replacing sooner. There is no fear of fire, nor of the house falling in during an especially heavy storm.



Scale 4 ft. to 1 inch

Plan for a Servant's quarter

The attached plan will show how these feature were secured. The plan shown is of the end unit, in which it is possible to put the two windows on the south. In succeeding units these windows are not possible. The provision of these windows makes this suite somewhat better than the others, and it is to be utilized for an overseer of slightly higher grade. It was not feasible, because of the site, to have windows at the back so clerestory windows or ventilators placed just under the roof were utilized for ventilation and light. This has the further advantage of reducing the possibility of thieves getting in from the back.

The walls of the main building are all 9-inch hollow walls.

The court-yard walls are only $4\frac{1}{2}$ inches thick with 9-inch pillars. All brickwork is of good brick and laid in lime. No mud mortar is used at any point. The roofs are of $4\frac{1}{2}$ inches reinforced brickwork. The roof of the main rooms is 11 feet high and the verandah 8 feet 3 inches, both inside. This allows room for clerestory windows on the verandah side also. These are 2 feet 6 inches by 18 inches, and provide ample light and ventilation. These heights seem ample in use.

The cooking-place is similar to a fireplace, and has a chimney carried out through the roof. It is marked "cholha" on the plan. A simple cooking-place is built inside the fireplace of mud or mud and brick, with holes for two pots to be heated from one small fire. This arrangement does not keep the pots clean, but it is very economical of fuel, however, and does provide for cleanness in that the smoke and strong smell from the cooking goes out of the chimney.

We consider the latrine arrangement very satisfactory and of great importance. Nothing causes more quarrels than the necessity for women to leave their quarters and go to a public latrine. This necessity also results in discomfort and actual injury to health when the latrine is some distance away or the weather inclement. It also leads to much fouling of the surrounding space by children. We consider it as essential to provide such facilities for servants and low-paid workers as for others. A simple latrine is built in one corner of the court-yard and fitted with a simple water-flushed seat. This seat is formed by using a common "gully trap" set under the cement-brickwork floor, with a channel for urine in front and foot-rests made of brick plastered as is the floor. It is flushed by simply pouring a bucket of water into it, about $1\frac{1}{2}$ gallons being required. A 4-inch pipe is run along the front of the quarters to serve all of them, and a septic tank is installed at the end of the line. We have had such seats installed now for over two years, and they have been very satisfactory; in fact, their fame has spread to the city, where they are being installed in private houses for connection to sewers. They have been installed not only in such quarters as these, but for men on salaries up to Rs. 200 per month, and are much preferred to sweeper-served arrangements. Using a relatively expensive absorption-pipe as was used here, the overall cost of such an installation will be about Rs. 25 to Rs. 30 per room where a number of units are installed. Experiments in cheapening the disposal system are under way which should bring the cost considerably lower. So-called absorption-pits are not recommended.

Attention to making the construction white-ant proof was given. The floors are of brick and cement-sand mortar. In this

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ŒCOLOGICAL REORGANIZATION OF RURAL INDIAN COMMUNITIES*

By A. M. Lorenzo, B.Com., M.A.

The Old Order Changeth

There has been a change both in the animate and the inanimate universe. Biological and social evolutions on parallel lines, and religious and industrial revolutions on convergent lines, exhibit the failures and achievements of an everchanging cosmos. Science is the cause of change. It has equipped man with tools of his own construction in the process of controlling his environment as a result of which man comes into constant conflict with nature. He struggles against the laws of nature and turns its forces to his own salvation. Science therefore guides the methods of his tilling and living.

Life has evolved from a primitive or collectional economic stage to the so-called civilized or cosmopolitan economic stage. The Malthusian postulates have become inapplicable in these days when the whole globe has been wound up with roads, railways, and canals and ship, and air routes. Adam Smith's "natural liberty" is buried with the past; but the hypothesis which Saint Simon had built up still holds good: that "the golden age of humanity is not behind us; it is to come." The greatest happiness of mankind is yet to be realized, and it will be found in the perfection of the economic and social order of the lower coinage of humanity.

The Classicists' Economics of Abstractism and the Utopian Doctrines of the 19th-century socialists no longer tend to cope with the present order of social and economic relativity. Life is constantly adopting the environment with a changed view. Hence the changes that influence the actor must affect the stage, and this represents the dynamic nature of the society and its economic modes and standards.

The old order is changing, yielding place to the new. India cannot avoid it. The struggle for existence has become too fierce *and demands* an entirely new equipment of modern science.

The Importance of Rural Reconstruction

Village uplift has become a by-word. It is not simply an uplift of the rural masses of India, but it is an interest of the whole world. The two chief motives behind this propaganda are (1) it is the development of our natural resources and their utilization in most productive and scientific ways, and (2) it involves ways and means for the economic and social progress of

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our producers, i.e., the village community. The chief characteristic of Indian economic life is the preponderance of agriculture as a result of which more than 93 per cent of the total population is absolutely Rural.

The pressure of population upon the land has constantly minimized the holding and lowered the standard of living. From 1872 to 1931 the population increased from 105 millions to 351·5 millions, or by 30·1 per cent. On the basis of absolute requirements, there is a good supply only for 264 millions, or 75 per cent of the present population. After making certain allowances, and considering other social and economic factors, the optimum population which India, with 250 millions of cultivated land (out of 480 millions of arable land), can support will be 176 millions, or only 50 per cent of the total population. Thus the extent of overpopulation in India would thus amount to one-third from the point of view of the absolute necessaries of life, and one-half from the point of view of a more liberal standard of living.

The agricultural population alone rose from 61 per cent in 1891 to nearly 78 per cent in 1931 (against 40 in France, 34 in Germany, and 32 in the United States of America), whereas the area under cultivation rose from 186 million acres in 1919 to only 200 million acres in 1929. The size of an average farm cultivated by a farmer and his assistants in Bengal is 2·5 acres against 21 acres in England and Wales. The *per capita* national income is below Rs. 80 against Rs. 295 in Japan, Rs. 1,319 in England, and Rs. 1,717 in the United States of America. Owing to epidemics, famines, and malnutrition, the average life of people in India is only 24·7 years as compared with 52 years in Italy and 56 years in Germany.

The relative poverty of the Indian people, as indicated by the comparison of population pressure, holdings, national income, etc., has necessitated the special attention both of the economist and the state. Indian people live constantly on the verge of starvation. The annual drain of food-stuffs has established the maxim that "people starve in rich environment." The immediate effects of overpopulation are famines, epidemics, under- or un-employment, migrations, desiccation of productive areas, and ultimately the dwindling of the village communities. These, in turn, disrupt the œcological balance of man and his environment.

From 1860-1900, besides the minor famines, there were seven most disastrous famines which affected an area of from 54,000 to 475,000 square miles, and a population varying from 20 to 68 millions. The influenza epidemic of 1918-19 alone was responsible for 8·5 million deaths, and plague took away 9·5 millions, during 1901-20. India's death-rate is twice, and the average length of life less than half, as much as in European countries.

The average creative period in India is only ten years as compared with thirty in European countries. Thus the low average length of life unfavourably affects the material and moral progress of the people.

India, with all her rich natural resources, lags behind other countries due to her defective and scanty capital and waste of labour-power. The retarded growth of industrialism, primitive productive processes, and insufficient state aid are some of the foremost stumbling-blocks. The remedies are irrigation, drainage, fertilization, acclimatization, improvements in production, conservation of forests and fisheries, acquisition of enormous capital for factory equipment, and exploitation of mineral wealth. But, above all, lies the needs of the rural masses in whose hands survives the most important factor of production.

The so-called increasing prosperity of rural India under British rule cannot veil the grip of poverty and indebtedness which besets the masses of the Indian population. The poorer classes are ever on the increase, and the web of indebtedness is constantly being woven and interwoven among the silent sufferers. The debt extends to the children, who remain bound till it has been discharged. My investigations in Bahraich showed that in one village of twelve families the total amount of debt was Rs. 1,205, the average burden per landless labourer Rs. 89, and Rs. 152 for small cultivators. In Nanpara the general incidence of debt on the indebted is Rs. 214, while on the whole cultivating body it falls to Rs. 99 of the whole debt, though 90 per cent is equal to more than 2 years' rent of the debtors. Further, our data for the three purwas of Bahraich disclosed that the total debt was three times the rent paid, and came to Rs. 16 per cultivated acre, or Rs. 116 per cultivator. Such investigations bring home the fact that a great work awaits the social reformers, the economists, and the state to formulate practical schemes for the economic and social amelioration of the people.

The state must step in through love. Legislation must work where custom has lost its force. If legislation is weak or negligent, the educated classes must strive to adhere to such beneficent activities as some societies (such as Servants of the India, Seva Samiti, Bengal Social Service League, Boy Scout, Girl Guide, and Village Uplift teams) have hitherto done.

Besides social welfare and progress, an extensive field lies untouched for rural economic surveys. The importance of such handy information is felt when practical schemes and working plans are to be worked up. Thanks to the efforts of Mann, Keating, Calvert, Jack, and Radha Kamal Mukerjee, their interest in the rural monographic surveys of the Deccan, Bombay, the

Punjab, Bengal, and Oudh respectively have done much for the betterment of the Indian peasantry.

Practical Schemes

The necessity of village reconstruction has been felt severely by all classes of men and all countries of the world. Arnold Lupton, in his remarkable work—"Happy India As It Might Be If Guided By Modern Science"—states the vital importance of village uplift which, in turn, would bear valuable results. He remarks that, "if the people of India wish to be healthy, wealthy, comfortable, and happy, they will at once carry out the well-known sanitary measures which I have mentioned. They will adopt a more intensive system of agriculture. They will proceed without delay with afforestation, and with great irrigation, drainage, and land reclamation works. They will get more hydro-electric-power-stations. And, at the same time, they will so organize their family life that the population does not tend to increase more than, say, one million a year, so that it shall not be necessary for death, in the shape of fever and other horrible diseases, to slaughter them." Some of the most valuable recommendations for the improvement of village conditions and the rural population are given by the Linlithgow Commission on Agriculture. I have tried to elucidate the main ideas in the following pages:—

Medical Relief and Public Health

A strong "forward" policy is emphasized. The supply of clean drinking water, opening of suburbs, filling up of dirty ponds where mosquitoes breed and multiply, personal cleanliness, and general sanitation are some of the immediate needs of the isolated villager.

One of the most deplorable cond.tions is the death of six million villagers every year from preventable diseases and malnutrition. The average age, both of males and females, is below normal, and contributes only 22 years of average life in the world. India's death-rate in 1927 was double that of England and Wales, and three times that of New Zealand. In India the expectation of life is approximately 35 years as against 54 in Great Britain. In other words, out of 100,000 boys and girls born alive in Denmark more than half would be living at the ages of 65, in British India just about half would be dead at ages between 11 and 13.

Child welfare, which is mostly neglected, is, in turn, the chief cause of the highest rate of infantile and maternal mortality among the village communities. The infantile mortality-rate was $2\frac{2}{3}$ times that of England and Wales, and about $4\frac{1}{2}$ times that of New Zealand. Further, 25·6 per cent of the total infant mortality

occurred in 1926, and 23·7 in 1927, whereas in England the percentages for the same periods were 10·7 and 9·5 respectively. In India 49·54 per cent of the total infant mortality occurred in the first month of life, and 65 per cent in the first week of life. Some of the chief causes were bad maternity work performed by indigenous dais, still births, respiratory diseases, infantile debility, premature births, convulsions, and dysentery.

The ignorance and superstitution of young and illiterate expectant mothers rewards them with premature maternal mortality. Thus in the Bombay Presidency one woman dies in childbirth for every 185 live births. The average urban and rural figures are one death per 115 and 207 live births respectively. In Kanara, for every 49 births, one mother is said to have died, and in Shikarpur (Sind) and Larkana one maternal death for every 31 births.

Nothing is possible until the general level of education is advanced under the Mackenzie scheme started in 1921. The progress of maternity and child-welfare work is hindered due to the lack of appreciation on the part of the rural masses, competition with indigenous dais, and weak public opinion. Insufficiency of funds has always been the pick of the problem; but the state must stabilize this department in the interest of the would-be stock of labour.

Taking the submontane districts of the United Provinces, as is only to be expected, preventable diseases account for the highest mortality among the rural masses. Malaria takes its customery place of pre-eminence, and reaches its maximum in August, September, and October. The presence of a high-water-level and defective drainage provides innumerable places for the anopheles mosquito. Bowel troubles, due to the prevalence of fever, and the resultant bitumen frequently found floating on the surface of well water, leave the people in a low state of vitality. The following table shows the chronic effect of fever alone which greatly affects the agricultural industry by keeping a large percentage of agriculturists and labourers out of employment:—

	Years	Effects on Rural Population
Gorakhpur and Basti—		p.c.
Malaria	1877-1907	77 5 of total mortality.
Cholera	1891-1900	9·5 ,,
Gonda and Bahraich—		
Malaria	1880-1902	74 ,,
Cholera	1872-1902	10·5 ,,
Meerut and Sultanpur—		
Malaria	1888-1901	90 ,,
Cholera	1891-1902	7 ,,

In spite of the fact that malaria and cholera account for 90 per cent of the total rural mortality, dispensaries are too inadequate and inefficient to handle the situation. Basti, with an area of 2,795 square miles and a population of 1,925,228 persons, had seven dispensaries—which is one dispensary for 399·5 square miles or for 275,033 persons. With an area of 2,627 square miles and a population of 1,065,377 persons, Bahraich had twelve dispensaries—i.e., one dispensary for 219 square miles or for 88,781 persons. Gonda and Meerut had one dispensary each for 187·5 and 197 square miles or for 98,207 and 124,923 persons respectively. The sparse distribution of both private and Government dispensaries clearly indicates the scarcity of medical relief for the teeming millions.

The scheme of quinine distribution through post offices has entirely failed, the "Dispensary on Wheels" scheme of the Health Bureau has suffered a similar tragedy, and the moving-pictures idea of the "Health Week," with a host of parasitic sanitary inspectors, has received but a cold welcome. Something was wrong somewhere!

Now the possible measures will be to reorganize such schemes under local village hierarchies and panchayats. Each village must be made an independent entity under the mukhiya or pradhan. It would be still better if the patwari serves as the medium between the state and the people. All philanthropic efforts should be taken through these heads; only then can the villagers reap the maximum benefit.

Diffusion of Primary Education

Rural education is cast in the midst of circumstances of farming and farm life. It consists in making adaptations and adjustments to the only heredity occupation—farming. At bottom, it has been largely a function of the home and family to transmit the techniques of the agricultural art. But the coming of scientific and commercial agriculture demands an education to adjust the real conditions and circumstances of life to the Great Society.

The aims of rural education should be to (1) train boys and girls to stay on farms; (2) train for vocational efficiency; (3) prepare for a satisfying or Richer Rural Life; (4) prepare for general efficiency and Community Service; and (5) train for broad citizenship. The agent system of both rural and urban education in India is defective. The *compelle intrare* (force them to enter) policy of Indian primary education has failed, as will be observed by the following data.

The severity of this problem is conspicuous by the fact that in 1921, out of a total population of 319 millions in India, 226

millions could read or write, and only 25 millions had literacy in English. In the United Provinces alone nearly 98 per cent were illiterate, and nearly 4 per cent had literacy in English. Literacy by caste was as shown below:—

1921	Total Population	Literate	Illiterate	Literacy in English
All Religions	45,375,787	1,688,872	43,686,915	175,239
Hindus (Brahmin)	10,025,032	1,331,562	37,074,062	98,219
Mohammadans	6,481,082	243,937	6,237,095	28,146
Christians	200,718	47,511	153,207	39,286

Considering the rural areas, literacy in any form was entirely absent in many districts. The submontane tracts showed the least signs of literacy. There were 868,770 primary schools (both rural and urban) for males, and 90,271 for females. Also there were 95,927 secondary schools (mostly urban) for males, and 14,756 for females. Including all the races, creeds, and depressed classes, the enrolment in various stages of education was—

	(Males)	(Females)
1. College Stage	7,054	57
2. High Schools	11,299	250
3. Middle Schools	69,112	1,840
4. Upper Primary	116,600	3,991
5. Lower Primary	671,759	84,190

The above returns are mostly in favour of urban areas. In rural areas even primary education is negligible, as shown by the percentages of attendance in some of the rural districts of the United Provinces—

	Total Scholars to Population	Female Scholars to Female Population	Male Scholars to Male Population
Gorakhpur	1·44	·17	2·67
Fyzabad	2·15	·21	4 07
Gonda	1·36	·11	2·56
Bahraich	1·37	·08	2·55
Sitapur	1·69	·28	2·93
Muttra	2 30	64	3 66
Meerut	2·48	·54	4·13
Kheri (Lowest)	1·29	..	2 27
Bahraich	..	·08	..
Lucknow (Highest)	4·09	..	..
Dehra	..	1·92	..
Almora	..	..	6·69

A scrutiny of the above facts shows that illiteracy is due both to the lack of schools and schooling. Further, literacy signifies the minimum of education. Reading has not been a rural custom, books are rarely given a place in the home, libraries are myths, and journals or magazines are but of nominal value to sweet-meat-sellers. It is all due to the inadequate attempts made by the Educational Department to raise the peasants from their ignorance.

The failure of the present system of rural education is due to three chief causes: (1) The equipment and organization of rural schools is most defective and unscientific; (2) the knowledge put before the rural population is quite unsuitable, and, finally (3) no emphasis has been paid to primary education. All eminent commissions have endorsed the development of higher education for urban areas; the rural population has been thought of as invincibly irresponsive to modern civilization.

The remedy lies in the making of the rural school. It must be adequately financed, scientifically equipped with appliances and teaching staff, and given to follow a well-set curricula, as suggested by Brayne in his "Remaking of Rural India." With this equipment the task of rural schools will be threefold: (1) To teach the fundaments, or rudiments, of education; (2) to furnish to children the general elements of our culture; and (3) to prepare children for participation in institutions of higher learning.

Besides the primary schools, other agencies of rural education, in order of importance, are the family, the farm, fairs, demonstrations, exhibitions, conferences, S.C.A., Y.M.C.A., and Y.W.C.A., health, recreational, and other civic organizations, rural libraries, agricultural education institutions, and the public platform.

It must be emphasized that after family training it is the rural school only which can meet all the requirements of rural education. In order to achieve real success, the rural schools must (*a*) relate themselves to other factors and conditions of life; (*b*) supply to the rural child's mind what rural environment lacks; (*c*) educate for life and living; and (*d*) redirect the old, and add some new, subjects—e.g., nature study, domestic science, manual art, music, and recreational games. Thus rural education must be recognized as the progressive adjustment to the changing circumstances of life and as the chief means of social progress.

Development of Rural Indigenous Industries

Diversity of occupation is the felt need of rural India. Agricultural countries are generally poor, and the severity of poverty can only be offset when cultivators are also men of skill and capable of adjusting their labour to seasonal changes in their occupa-

tion. The waste of rural labour due to the seasonal character of agricultural operations brings about an enforced unemployment which, on an average, lasts from 150 to 270 days in the year. Due to the absence of any supplementary industries auxiliary to agriculture, this period of inactivity is beguiled and wasted away in useless recreations, festivals, gossip, tales, and "derring-do." Slater found that, in South India, all the year round there is agricultural work for the cultivator only for five-twelfths of his possible working time; Jack, in Bengal, has estimated 9 months' idleness for jute-growers and 7½ months for jute- and rice-growers; Keating, in the Bombay-Deccan, found only 180-190 working days in the year; Bhalla and Calvert, in the Punjab, have estimated 270 and 150 days' full labour respectively; and Mukerjee's estimate; in Oudh, came to 150 days. My investigations in the submontane tracts of Gonda and Bahraich give an average of 177 days' full labour and 188 days' wastage—i.e., 52 per cent of the cultivators' time is wasted for lack of any subsidiary employment. This means a tremendous loss of income which, when calculated according to the average yearly rate of wages, comes to between Rs. 50 and Rs. 90.

It is therefore very necessary that cottage industries should be developed to exploit the natural resources of the village and adjust the seasonal feasting and fasting of the cultivator. Dr. R. K. Mukerjee observes that, "apart from increasing productivity by heavy-yielding crops, another method of adjusting population to resources is the introduction of various subsidiary industries in connection with agriculture." The prominence of the village artisan at the time of fairs, markets, exhibitions, and festivals brings him casual incomes; but, if his occupation is carried on in association with agriculture, it will be a boon to all engaged in it.

Some existing cottage industries carried on partially with agriculture are the tapping of palm-juice, vegetable and fruit culture, crude saltpetre extracting, grass-cutting, rope-making and basket-weaving, seri-and silvi-culture, dairying, bone- and rag-collecting, pottery, bangle-making, fishing, etc. If these industries are systematically organized and developed, the condition of the agricultural population would be much improved by increased incomes. Women and young girls should play an important role in the revival of domestic handicraft. Owing to customary bonds, in certain parts of the country, under the influence of guild socialism, female artisans do not come out—as we find in Lucknow and in the Gota-Kinari works of Chowk and the Moradabad brasswork guilds. But in the Cawnpore and Farrukhabed districts calico-printing and pottery-painting are carried on by the womenfolk at home, and the finished product is marketed by the male members of the family. The co-operative societies have much developed these industries by financing them with short-term loans, marketing the produce,

rendering honorary services of industrial experts, and standardizing the products of the untrained villagers.

The chief idea behind this problem, as foreseen by the eminent commission aforesaid, was to utilize the leisure periods of the villagers, to provide them with new sources of earning (as they need more income), and, finally, to develop the trivial cottage industries which stand as the foundations of national industrial development.

Further, co-operative credit, co-operative marketing, and co-operative production would bring about a remarkable change and success in this line. Improved methods of production, sanitary housing, shopping conditions, and healthy environment in technical education not simply to improve the methods of agriculture, but "to inspire the young with a love of country life," improvement in the means of transportation (roads connecting the neighbouring markets with the village), etc., should be some of the foremost considerations in carrying out a successful scheme. *Rural dairy farming has a great scope and future, provided it is carried on on improved and sanitary lines, which is possible only through co-operative wholesale purchases and retail distribution.* Similarly, poultry farming, if carried on scientifically and supervised by trained men, would prove profitable. Embroidery, chikan-work, calico-printing, ivory-carving, pottery, toy-making, etc., can easily be mastered, even by pardah-nashin women, to make a considerable amount of income during their leisure hours.

The *charkha* doctrine, as inculcated by Mahatma Gandhi, stands to provide work for the unemployed, and ensures an income to those having limited means. Its primary motive is economic—

(*a*) Utilization of leisure to earn small incomes in association with their main occupation, i.e., agriculture.;

(*b*) To support one's family (or personally) with cheap cloth, thus realizing the value of one's own spun cloth.

(*c*) To realize political ends, the *charkha* is a means to it; and

(*d*) To create a spirit of nationalism, the love of country and co-operation with fellow-men, by supporting such Indian industries which are mostly in the domestic stage.

Thus we see that agriculture alone is insufficient, but agriculture in association with subsidiary industries to utilize its by-products is needed—and badly needed. If each rural family carries on a cottage industry directly or indirectly allied to agriculture, the problem of poverty and indebtedness would not be so severe.

If such opportunities are continuously wasted, and not utilized, the cultivator can never get rid of the bonds of indebtedness and the blows of poverty.

Rejuvenation of Cultural Traits

If there is a bondage in the country-side, it is the bondage of ignorance and a custom-ridden life. Tradition, rather than reason, governs family organizations, æsthetic and recreational activities, and other social institutions. The touchstone of civilization has not been able to convert the conservative peasantry to a more scientific and modern view of life. Social control is still very rigid, and rejects the modern Socrates of Indian villages who has been endeavouring to change the rural personality.

Social life is not changed: it changes by itself. It is not created, but renewed by certain processes. Social changes in social adaptation would be forced by physiographical environment. The structure of dwellings, village sites, and settlements, formation of social communities in arid regions, religious patterns, and types of government all are determined upon an environmental basis. It is only recently that sociologists have started studying the physicial, vital, and psycho-social traits of the farmers and peasants. Indian conditions are still left untouched and a wait a scientific study.

The evils of pardah, bad housing, malnutrition, absence of recreation, etc., are some of the sham facts of easy-chair writers. The village workers, equipped with a rudimentary knowledge of rural sociology, have not been able to understand the œcological formation of village communities, hence the misrepresentaion of facts. Social uplift will be treated in a subsequent article on the "Œcological Processes of Rural Social Communities in Northern India." For the present it will suffice to mention three ideas for village uplift workers to keep in view: (1) A study of the physical traits (comparative health) of the rural population, and ways and means to improve them; (2) a study of the vital processes, rural intelligence, mental health, psychological processes, and predominant attitudes of the rural folk, and measures for their amelioration; and (3) a comparative study of all social classes, rural-urban relationships and migrations, and their effect upon the whole population. These studies of the fundamental functions of rural rocial life will draw us closer into the life of the history of the nation and mankind.

Method of Approach

We start with the assumption that the rural occupations, the social status of the people, and the hierarchical gradation of village communal functionaries are degraded, unattractive, and remote from

the touch of civilization. The village community is looked down upon as if it were still hovering between savagery and civilization. Village life with a simple stimuli is less attractive for the city-sick population. This is our biased view. We lack both knowledge and æsthetic fervour. The old economists touched the dark sides, but the modern economists will excavate the new.

The Indian village has perfect social and economic organizations, and from time immemorial has been contributing much to modern civilization. Urban-social institutions rest upon rural culture, where we find the survival of the co-operative spirit, communal property, and labour, and the older kinship feelings which existed long before in the now-dwinding village communities. These villages of common brotherhood still exhibit a good deal of solidarity of economic interest, and some examples of the co-operative and communal culture of ancient India can be found among the village communities along the banks of the Ganges and its tributaries.

The best method of approach is not in the form of punitive expeditions—with a host of sanitary inspectors, scavengers, and band boxes full of bottles and other instruments—to frighten people; it is based on definite œcological principles.

The œcological idea is ambiguous, and involves—

(1) The scheme based upon environmental conditions. Before launching out on any scheme a systematic collection of data relating to prevailing conditions is necessary. The scheme should be adaptive, simple, and the least expensive; and

(2) The scheme based upon the reorganized principles of older, or even decayed, social and hierarchical institutions. Thus mukhiya, the panchayat, and the patwari are the best sources through whom village uplift propaganda should be followed by a constructive programme.

Thus we have come to the conclusion that village uplift involving the economic and social reorganization of rural institutions should be worked upon œcological principles: Firstly, that man and region should be treated as interdependent entities; and, secondly, that social institutions which grow spontaneously within certain physiographical influences should not be rejected, but modified, polished, and even reshaped to meet the needs of a progressive society.

Village uplift is not the cleaning of suburbs, filling up of ponds, constructing pacca wells, disributing medicines, and delivering lectures on health and hygiene. It is something deeper than this waste patchwork. It touches the sources of human happiness, and suggests ways and means to develop it. Thus village uplift is not of the village area, but of the community at large, and it maintains an œcological balance between life and region.

TRAVELLING AGRICULTURAL EXHIBITIONS

Held in the Chail and Manjhanpur Tahsils of the Allahabad District in 1932-33 *and* 1933-34

It will not be out of place to mention that the Allahabad Agricultural Association, which came in existence in 1926, is doing its best to improve agriculture and uplift the condition of villagers in the district by adopting different programmes of improvements in co-operation with the Agriculture Department.

It has been already admitted that agricultural exhibitions do immense good, and serve the purpose of a vast propaganda work in popularizing a variety of things, new methods, etc., to the majority of the people far and wide, and in a very short time bringing about a change in the minds of visitors towards the adoption of the new things and methods exhibited therein.

Thus, with the same view, the Agricultural Association, securing the full co-operation of the Agriculture Department, started its scheme of exhibitions. First, the district exhibition on the occasion of the Magh mela last January was organized; but this was not found sufficient to popularize all the improved methods of the department in such a short period amongst the general masses contained in such a vast district as Allahabad. Thus it was thought that exhibitions be held in villages, and these were named "travelling exhibitions," i.e., the propagandists carrying improved seeds and labour-saving implements on bullock-carts, with bullocks and trained ploughmen, for giving practical demonstrations from village to village and halting at each important place in the district. These were started in 1928, and are continuing still.

The result of this vast propaganda, by which the voice of improvement has reached from village to village to the ears of person to person, is that it has brought about a real change in the minds of cultivators; and it seems that the spirit of the adoption of improvements has been produced amongst the general masses of the district. The Agricultural Association and the activities of the department have also been made widely known in such a short period in the district that the introduction of any improvement finds easy access amongst the cultivators. It is on account of these successive village exhibitions that a revolution in the thoughts of the cultivators, who are by nature conservative for improvement, has been produced.

The same programme of the travelling exhibitions in villages, as chalked out by Mr. B. Joti Prasad, Divisional Superintendent of Agriculture, Allahabad, was begun on the 15th June last at the

termination of the teachers' training class; the following were the towns visited, with the dates:—

1.	Kutia	15th June	Chail Tahsil
2.	Tilhapur	16th & 17th June	
3.	Purkhas	18th "	
4.	Sarai Akil	19th "	
5.	Kanaili	23rd to 25th "	Manjhanpur Tahsil
6.	Bidawan	26th "	
7.	Shahpur	28th & 29th	
8.	Sarsawan	30th June & 1st July	
9.	Manjhanpur	3rd & 4th "	
10.	Kokhiraj	6th "	Chail Tahsil
11.	Mahagaon	8th & 9th "	
12.	Sallahpur	10th & 11th "	
13.	Bamrauli	12th "	
14.	Begum Sarai	13th "	

After arranging shows at each of the above places the people were shown all sorts of improvel seeds, improved ploughs, and other implements of importance suited to village needs, with practical demonstrations of each. Lectures on different subjects of improved agriculture, explaining the advantages of improved methods, and how to utilize them in improving cultivation and bringing about an increase in the yield of crops and affecting economy in expenditure, were delivered to the cultivators; the same were practically demonstrated by magic-lantern lectures at important shows. Some of the important subjects on which lectures were given are noted below:—

(1) The advantages of good cultivation, and how it can be brought about by Meston ploughs and other improved implements;

(2) How the cost of cultivation can be economized, and the deficiency of labour overcome, by the use of labour-saving implements;

(3) How to get increased yields from different crops by using better seeds and improved implements, and getting better profits by taking special care in marketing produce;

(4) On the use of different manures, the preservation of cattle-dung and urine manure, and the use of sanal for green manure;

(5) On the use of different water-lifts, and the economy thus brought about; and

(6) On the improvement of cattle, their rations, etc., showing their importance in agriculture.

The Divisional Superintendent of Agriculture, the Secretary, Agricultural Association, and the Agricultural Engineer, Naini Agricultural Institute, took special interest in bringing about the shows successfully, and attended personally at important places like Tilhapur, Sarai Akil, and Manjhanpur.

There was a satisfactory gathering at the above places, especially at Tilhapur, Sarai Akil, and Manjhanpur owing to the special attention shown by Thakur S. K. Sheo Pratap Singh, Zamindar and Member, District Board of Tilhapur; Thakur Sheokaran Partap Singh, Sub-Inspector of Police of Sarai Akil; and the Tahsildar and Naib-Tahsildar of Manjhanpur.

The Sanitary Inspector of the Chail Tahsil also attended the agricultural shows at places in the Chail Tahsil, and gave lectures on sanitation.

The agricultural shows terminated on the 14th July as the rains set in, but will be restarted after the rainy season in other tahsils.

Pandit Shilla Prasad, Agricultural Inspector, was in charge of the training exhibition.

NAND KISHORE SRIVASTAVA,
Superintendent of Agriculture, Allahabad.

(*Continued from page* 318)

case, to cheapen the construction, the floor was not plastered, the brick being left exposed. This reduces the cost by nearly half, but gives a serviceable floor through which the ants do not come, and which is easily kept clean. Both the room and the verandah are so floored.

Thought was taken to provide the maximum facilities for storing household goods.

The problem of nutrition in India has been solved by Colonel R. McCarrison, Pasteur Institute, Coonoor. He says that the diet most likely to maintain physical efficiency and health is one composed of any whole cereal grain or a mixture of cereal grains, milk, the products of milk—butter, curds, and butter-milk, legumes, green leafy vegetables, root vegetables, fruit, and water with meat occasionally.

METEORLOGICAL OBSERVATIONS AT THE ALLAHABAD AGRICULTURAL INSTITUTE FARM

September, 1933

Date 1933	Maximum Temperature	Minimum Temperature	Mean	Humidity	Barometric Pressure	Rain for the Day	Rain since January 1	Rain since June 1	Wind	Remarks
Sept. 1.	89·5	77·5	83·5	83 %	29·40	0·03	22·39	17·40	S.W.	
" 2.	89 0	77·0	83·0	88 %	29·40	0 20	22·59	17·60	S.W.	
" 3.	89 0	80·0	84·5	82 %	29·38	*Nil*	"	"	W.	
" 4.	90	80	85·0	79 %	29·46	"	"	"	N.W.	
" 5.	91	79	85	80 %	29·44	"	"	"	S.W.	
" 6.	91	79·5	85·25	82 %	29·44	"	"	"	S.W.	
" 7.	92	80·0	86·0	87 %	29·40	"	"	"	E.	
" 8.	91	78	84·5	90 %	29·40	0·61	23·20	18·21	E.	
" 9.	88	78	83	83 %	29·46	Trace	"	"	E.S.E.	
" 10.	91	80	85·5	79 %	29·47	..	"	"	E.	
" 11.	93	80	86·5	75 %	29·50	..	"	"	E.S.E.	
" 12.	94	79	86·5	70 %	29·44	.	"	"	E.	
" 13.	93	80	86·5	72 %	29·45	..	"	"	E.	
" 14.	94	80	87	74 %	29·35	..	"	"	E.S.E.	Rain in the neighbourhood
" 15.	95	80	87·5	70%	29·47	Trace	"	"	E.S.E.	
" 16.	94	78	86·0	66 %	29·46	·05	23·25	18·26	E.	
" 17.	92	77	84·5	65 %	29·41	..	"	"	E.	
" 18.	92	77	84·5	64 %	29·30	..	"	"	S.S E.	
" 19.	94	78	86·0	65 %	29·28		"	"	S.	
" 20.	94	78	86·0	85 %	29·31	..	"	"	W.	
" 21.	84	76	79·0	86%	29·30	·61	23 86	18·87	N.N.E.	
" 22.	84	76	80·0	91 %	29·22	·87	24 73	19·74	N.	
" 23.	84	76	80·0	86 %	29·19	1·30	26·03	21·04	E.	
" 24.	83	77	80·0	80 %	29·35	0·35	26·38	21·39	E.	
" 25.	86	74	80·0	75 %	29·60	..	"	"	W.	
" 26.	86	70	78·0	82 %	29·56	..	"	"	W.S.W.	
" 27.	88	75	81·5	76 %	29·60	..	"	"	W.S.W.	
" 28.	87	76	81·5	70 %	29·60	..	"	"	W.S.W.	
" 29.	89	77	83·0	66 %	29·60	..	"	"	Calm	
" 30.	89	77	83·0	64 %	29·62	..	"	"	S.	

MONTHLY AGRICULTURAL REPORT FOR AUGUST, 1933

U. P. Department of Agriculture

I.—Season

Light rain was received in the first two weeks of the month, but moderate to heavy rain fell in the latter fortnight of the month. The total rainfall was very unevenly distributed; it was above normal in Bulandshahr, Agra, Fatehpur, and parts of the Benares and Gorakhpur Divisions, about normal in some districts, and distinctly deficient in others, especially in the Lucknow Division. A statement showing the distribution of rainfall by districts is appended, and will be found on page.

II.—Agricultural Operations

Agricultural operations are generally well forward, except where retarded by deficiency of rainfall. Preparation of land for the rabi continues.

III & IV.—Standing Crops and Prospects of Harvest

Standing crops are on the whole doing well, except in tracts of distinctly short rainfall. Kharif crops, particularly paddy, suffered for want of sufficient and timely rain over a large area. Prospects are, on the whole, favourable.

V.—Damage to Crops

Floods have slightly damaged crops on low-lying land in a number of districts.

VI.—Agricultural Stock

Cattle diseases have increased as compared with last month. The following figures of mortality are furnished by the Director, Civil Veterinary Department:—

	Seizures	Deaths
Rinderpest	4,273 ...	2,634
Foot-and-Mouth Disease ...	9,318 ...	790
Hæmorrhagic Septicæmia ...	1,138 ...	608

VII.—Fodder and Water

Two districts report scarcity of fodder; elsewhere it is sufficient.

VIII.—Trade and Prices

Prices of staple grains have fallen slightly. The following figures show the average retail prices in rupees per maund:—

	End of July	End of August
Wheat	3·150 ...	2·996
Barley	2·175 ...	2·043
Gram	2·564 ...	2·405
Rice	4·041 ...	4·020
Arhar Dal	3·810 ...	3·749

IX.—Health and Labour in Rural Areas

Agricultural and labouring classes can find employment at good wages. Public health continues satisfactory. There is no widespread epidemic.

"There are about 1,750 officers in the Provincial Veterinary services, all specially trained and experienced in live-stock matters, but the great majority are not utilized at all in connection with provincial live-stock improvement measures."

"The Veterinary Officer possessing a sound knowledge of the science and practice of dairying and animal husbandry is the foundation upon which the future development of the dairy industry in India will depend."

"The solution of the fodder problem in India lies in educating the cultivator to the value of ensilage; grass silage is the corner-stone on which the Military Dairy Farms have been built up in India."—*Colonel G.F. Mellor Director of Farms, A.H.Q., Simla.*